

ESG in transition: A text mining analysis of how Indian corporations evolved from checkbox reporting to strategic integration

Priyanka Aggarwal ^{1*} , Archana Singh ¹ , Deepali Malhotra ¹ 

¹ Delhi Technological University, INDIA

*Corresponding Author: aggarwal.priyanka021@gmail.com

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ABSTRACT

This study analyzes sustainability reports of 269 NIFTY 500 firms from FY2015 to FY2023 using text mining to track the evolution of corporate ESG reporting in India. The study employed Orange software to process and analyze textual data, generating word clouds and frequency analyses to identify temporal patterns. The analysis reveals three distinct phases: initial establishment (2015-17), governance consolidation (2018-20), and balanced integration (2021-23). Governance terms consistently dominated across all periods, with “business” and “profit” being most frequent. Social reporting centered on employee welfare, while environmental terms, particularly “energy,” showed steady growth. The findings demonstrate that Indian corporations have shifted from compliance-driven disclosure to strategic ESG integration, with implications for regulatory frameworks and investment decisions.

Keywords: temporal ESG evolution, text mining, corporate sustainability narratives, ESG disclosure patterns, strategic sustainability integration

INTRODUCTION

Over the past decade, the concept of a sustainable business model has undergone substantial transformation worldwide, driven by the growing prominence of environmental, social, and governance (ESG) imperatives. Sustainability reporting, once largely voluntary, has increasingly become a central element of corporate governance as firms respond to mounting stakeholder pressures—particularly from investors—for greater transparency and accountability in ESG practices (Al-Shaer & Zaman, 2018; Amel-Zadeh & Serafeim, 2017; Freitas Netto et al., 2020; Hassan & Mahrous, 2019; Stolowy & Paugam, 2018). This shift has been reinforced by global regulatory initiatives such as the International Sustainability Standards Board (ISSB) and the European Union’s Corporate Sustainability Reporting Directive (CSRD), which seek to harmonize disclosure requirements and enhance comparability across jurisdictions. Parallel to these global developments, ESG reporting has expanded rapidly in both developed and emerging markets, particularly in the aftermath of the COVID-19 crisis. Prior studies document that periods of crisis often trigger increases in ESG disclosure as firms attempt to signal resilience, ethical conduct, and long-term orientation to stakeholders (Amosh & Khatib, 2023; Barker, 2025; Maji &

Lohia, 2024; Wang et al., 2023). However, the literature also cautions that higher disclosure volumes do not necessarily translate into improved sustainability outcomes, highlighting persistent concerns related to symbolic reporting, boilerplate narratives, and greenwashing (Adams & Abhayawansa, 2021; Arvidsson & Dumay, 2021; Lin et al., 2024). Consequently, scholars increasingly call for longitudinal and content-focused analyses that move beyond disclosure quantity to examine the evolution, emphasis, and strategic depth of ESG narratives over time (Marie et al., 2024; Pasko et al., 2022; Quttainah & Paczkowski, 2025). India reflects this broader global trajectory while also exhibiting a distinct regulatory evolution. The country’s ESG landscape has progressed from voluntary corporate social responsibility guidelines to mandatory CSR spending and, more recently, to structured sustainability reporting frameworks. A key inflection point in this transition was the introduction of the Business Responsibility and Sustainability Reporting (BRSR) framework by the Securities and Exchange Board of India (SEBI), which institutionalized standardized ESG disclosure for listed firms (Chandra & Samanta, 2025; Rajan, 2025). BRSR has been characterized as a seminal regulatory intervention that aligns Indian corporate reporting practices with global ESG norms and the United Nations Sustainable Development Goals, while aiming to enhance transparency, accountability, and cross-firm

comparability (Rajan, 2025). Emerging empirical evidence on Indian ESG and BRSR disclosures reveals a mixed picture. While several studies identify a persistent compliance-driven mindset, vague qualitative language, and risks of greenwashing, they also suggest that BRSR is gradually encouraging firms to adopt clearer metrics, improved risk identification, and stronger stakeholder-oriented governance practices (Chandra & Samanta, 2025; Kassier, 2024; Rajan, 2025). Sector-specific research further indicates that ESG dimensions—particularly the governance pillar is increasingly linked to financial performance, resilience, and long-term competitiveness in industries such as healthcare and information technology (Arun et al., 2025; Maji & Lohia, 2024). Methodologically, prior studies have demonstrated the value of text mining and content analysis techniques in tracing the evolution of ESG reporting across countries and industries. Longitudinal and phase-based approaches have been widely applied to capture shifts from standardized, compliance-oriented disclosures toward more strategic and differentiated sustainability narratives (Baier et al., 2020; Jeong, 2025; Xia et al., 2023; Yoon et al., 2023). While such approaches have been employed in contexts such as Korean firms' ESG-SDG alignment (Yoon et al., 2023) and technology-sector disclosures, systematic longitudinal evidence from emerging markets—particularly in response to specific regulatory reforms—remains limited. Against this backdrop, the present study offers a novel, India-focused contribution by examining the longitudinal evolution of corporate sustainability reporting over a nine-year period. Using a text mining-based content analysis, the study develops a detailed phase-based framework to trace how Indian firms' ESG reporting practices have evolved in response to regulatory milestones such as the BRSR framework, global shocks like the COVID-19 pandemic, and changing stakeholder expectations. By identifying shifts in the relative prominence of ESG pillars and the transition from a predominantly compliance-driven mindset toward more strategic sustainability integration, this research provides deeper insights into why sustainability reporting in India has moved from being a “nice-to-have” disclosure to an essential component of corporate strategy. In doing so, the study contributes to ongoing debates on ESG disclosure quality, regulatory effectiveness, and the substantive integration of sustainability into corporate decision-making in emerging markets. Over the past decade, the concept of a sustainable business model has undergone substantial global changes (Brehmer et al., 2018). The proliferation of environmental, social, and governance (ESG) imperatives has created additional demands from stakeholders. Sustainability reporting, once a voluntary disclosure, is now a crucial component of corporate governance (Hassan & Mahrous, 2019). This is driven by increasing pressure from stakeholders, especially investors, for transparent ESG practices (Al-Shaer & Zaman, 2018; Amel-Zadeh & Serafeim, 2017; Freitas Netto et al., 2020; Stolowy & Paugam, 2018). Regulatory efforts like the International Sustainability requirements Board (ISSB) and the European Union's Corporate Sustainability Reporting Directive (CSRD) have further increased the need for standardized and stringent disclosure requirements. India has mirrored this global trend by making sustainability reporting mandatory. This began with the top 100 firms in 2012, and by 2021, the introduction of the Business Responsibility and

Sustainability Reporting (BRSR) system further solidified this requirement. While previous studies have utilized text mining for ESG analysis—such as Yoon et al. (2023) focusing on Korean firms' alignment with SDGs—the research is distinct in its focus on the Indian market's response to specific regulatory changes like the BRSR framework. We provide a detailed, phase-based framework to chart this evolution, identifying how different ESG pillars gained or lost prominence in response to both national regulations and global events like the COVID-19 pandemic. The results show that Indian companies have changed their reporting practices, and they also explain why sustainability is now an essential need rather than a nice-to-have. Regulations for new markets, investment evaluation processes, and strategies for the long-term health of firms are just a few things that need to change to accommodate this change. The objective of this study is to shed light on the evolution of corporate sustainability reporting by meticulously examining the ways in which reporting procedures have evolved in response to changing legal frameworks, global crises, and stakeholder expectations. This study's unique contribution lies in its comprehensive, longitudinal analysis of Indian corporate sustainability reports over a nine-year period, specifically examining the transition from a compliance-focused mindset to a more holistic, strategic approach.

REVIEW OF LITERATURE

In recent decades, text mining has emerged as a widely used methodological approach for analysing corporate sustainability and ESG reports, enabling researchers to systematically identify dominant themes, shifts in emphasis, and patterns across firms, sectors, and countries. Early studies consistently demonstrate that sustainability disclosures are far from homogeneous and vary significantly depending on industrial context and reporting environments. For instance, Modapothala et al. (2010) applied text mining and multi-discriminatory analysis to corporate disclosures and showed that reporting practices differ substantially across industries, with environmental variables receiving greater emphasis in environmentally intensive sectors. Similarly, Goloshchapova et al. (2019), using natural language processing and Latent Dirichlet Allocation (LDA) on CSR reports of MSCI Europe firms, identified recurring themes such as employee safety, carbon emissions, and human rights, while highlighting strong sectoral biases—industrial firms emphasizing employee safety and utilities focusing on energy efficiency. Subsequent research extended this line of inquiry to cross-country and emerging market contexts, revealing pronounced national and institutional differences in ESG reporting practices. Kumar and Das (2021), analysing sustainability reports from 200 firms across developed and developing economies using text mining techniques, observed a sharp increase in the adoption of Global Reporting Initiative (GRI) standards but found wide disparities in disclosure quality, with Canadian firms ranking highest and Indian and Chinese firms among the lowest. Yoon et al. (2023) conducted a detailed text mining study of Korean firms' ESG disclosures in relation to the United Nations Sustainable Development Goals, employing bigram frequency analysis, TF-IDF weighting, and semantic network analysis.

Their findings revealed strong emphasis on consumer protection and digital human rights but a notable lack of focus on global partnerships, underscoring gaps between reporting practices and SDG priorities. More recent studies deepen these insights by explicitly examining country- and sector-specific reporting trajectories over time. Heichl and Hirsch (2023) analysed European Union non-financial reports from 2017 to 2021 using dictionary-based and bag-of-words approaches to construct a “Sustainable Fingerprint.” Their results show increasing report length, more future-oriented language, and clear differentiation in ESG emphasis across countries and sectors. Sharma et al. (2022), analysing Fortune 500 sustainability reports, similarly documented systematic variation in ESG emphasis driven by firm size, sector, country, and reporting tenure, proposing an expanded EESG (economic, environmental, social, governance) comparison framework. Longitudinal evidence from emerging European contexts further supports these patterns: Białek-Szkudlarek (2025) examined Polish banks’ sustainability reports from 2006 to 2023 and found rising ESG disclosure volume, increasingly neutral sentiment in ESG sections, and growing linguistic complexity as regulatory requirements tightened. Studies focusing on Central and Eastern European firms under the ESRS framework likewise reveal uneven ESG emphasis, with climate change disclosures dominating other pillars and larger firms achieving higher disclosure scores (Suta et al., 2025). Alongside this expanding empirical scope, the literature reflects a steady evolution in methodological approaches to analysing ESG narratives. Dictionary-based and frequency methods remain widely used to capture disclosure volume and balance across ESG pillars, as illustrated by Heichl and Hirsch (2023) and Kiriu and Nozaki (2020), who demonstrate that the quantity and specificity of environmental, social, and governance language in Japanese CSR reports are predictive of both current and future ESG performance. Topic modeling approaches, particularly LDA, have gained prominence for uncovering latent thematic structures in sustainability reports. Contala et al. (2024), analysing DAX 40 firms, show that while LDA captures many GRI-related topics, results are highly sensitive to preprocessing choices, underscoring important methodological constraints. Similar conclusions emerge from cross-country CSR analyses, where common topics coexist with strong sectoral biases (Goloshchapova et al., 2019). More advanced natural language processing techniques further extend this methodological frontier. Baier et al. (2020) developed an extensive ESG dictionary based on 10-K filings and proxy statements, finding that approximately 4% of corporate language is ESG-related and that shifts in ESG wording closely track real-world events and media shocks. Bronzini et al. (2023) applied large language models combined with retrieval-augmented generation to extract over 500 ESG topics, revealing strong regional and sectoral similarity patterns and a positive association between richer disclosure and ESG ratings. Schimanski et al. (2024) advanced this stream by pre-training ESG-specific NLP models on 13.8 million text samples to quantify ESG communication and explain variation in ESG scores. At the same time, concerns regarding symbolic disclosure and greenwashing have prompted methodological innovations aimed at evaluating disclosure credibility. Lagasio (2024), for example, proposed an ESG washing Severity Index based on sentiment and term frequency to detect

discrepancies between corporate rhetoric and actual sustainability behaviour. Taken together, this growing body of literature underscores three consistent findings: First, ESG and sustainability reporting exhibits substantial variation across countries, sectors, and time; second, regulatory tightening is associated with increased disclosure volume, complexity, and standardization; and third, methodological approaches have progressed from simple dictionary and frequency analyses toward topic modeling and large language model-based pipelines. However, despite these advances, longitudinal, regulation-focused text mining studies from major emerging markets remain limited. This gap provides a clear foundation for the present study’s longitudinal, phase-based text mining analysis of Indian corporate sustainability reporting in response to regulatory reforms and external shocks.

In recent decades, researchers have widely used text mining to analyse corporate sustainability reports, identifying trends and key topics. These studies consistently show significant variations in the content and emphasis of these reports. Modapothala et al. (2010) used text mining and multi-discriminatory analysis to demonstrate that corporate disclosures vary significantly by industrial sector, with environmental variables playing a more prominent role in some industries. Yoon et al. (2023) conducted a text mining study to evaluate how Korean firms report on ESG in the context of the UN Sustainable Development Goals (SDGs). Their analysis, which included bigram frequency, TF-IDF, and semantic networks, found a strong emphasis on consumer protection and digital human rights but a surprising lack of focus on global partnerships, which are crucial for achieving the SDGs. Kumar and Das (2021) employed a text mining approach to study sustainability reporting practices across 200 firms in developed and developing nations. Their findings revealed a substantial increase in the use of Global Reporting Initiative (GRI) standards and ranked Canada as the highest-performing country in disclosures, with Indian and Chinese businesses ranking lowest. Goloshchapova et al. (2019) analyzed CSR data from MSCI Europe companies using NLP and Latent Dirichlet Allocation (LDA) to identify frequently reported themes. They found themes such as “employee safety,” “carbon emission,” and “human rights,” and noted a clear industrial emphasis on the subject matter of CSR reports, with different industries focusing on different issues (e.g., industrial companies on “employee safety,” utilities on “efficient power”).

METHODOLOGY

Sustainability disclosures of 269 companies from the NIFTY 500 index were collected for the financial years FY2015 to FY2023 from the official websites of the respective companies. To ensure comprehensive coverage of ESG-related communication, multiple forms of corporate disclosures were included, such as standalone sustainability reports, ESG reports, corporate social responsibility (CSR) reports, Business Responsibility Reports (BRR), and Business Responsibility and Sustainability Reports (BRSR). Assuming consistent reporting across the study period, the dataset comprises a total of 2,421

firm-year reports (269 companies over 9 financial years). These documents collectively form the textual corpus for subsequent analysis. Text mining of sustainability reports was done using Orange software. Previous studies have shown how text mining can derive important information from corporate communications. Text mining facilitates the finding of patterns within vast document collections and discovers related subjects by examining the text content. This approach helps uncover significant contexts that would be difficult to identify manually, providing for more comprehensive and meaningful exploration of large document quantities (Park et al., 2023). Orange is an open-source visual programming environment that emphasizes interactivity and intuitive, widget-based workflows, making it accessible to users with varying levels of expertise in data mining and machine learning (Curk et al., 2005; Demšar et al., 2013). The Text add-on in Orange provides components for text mining, visualisation, and deep-learning-based embeddings, enabling users to manage, preprocess, and analyse textual data to uncover hidden patterns and evaluate models (Joyce & Kranjc, 2018; Toplak et al., 2017). It supports core text preprocessing techniques, including document vectorisation, stop-word removal, lemmatization, and stemming, which are essential for effective text analysis (Aggarwal & Zhai, 2012; Bateman et al., 2008; Heimerl et al., 2014; Manning et al., 2008; Viégas & Wattenberg, 2008; McNaught & Lam, 2010).

The following six stages were performed to analyse the reports.

Document Import and Organization

The initial stage involved systematic collection and organization of sustainability reports from the selected 269 NIFTY 500 companies spanning fiscal years 2015 to 2023. Reports were comprehensively gathered from official company websites, specifically targeting investor relations sections, sustainability portals, and corporate governance pages. The collection encompassed various reporting formats including dedicated sustainability reports, ESG reports, Business Responsibility Reports (BRR), Business Responsibility and Sustainability Reports (BRSR), and CSR reporting documents. For efficient management and retrieval, a structured hierarchical file system was implemented. The main directory was organized into ten sector-specific folders based on Bloomberg classification. Within each sector folder, individual company folders were created, which were further subdivided by fiscal years. This methodical organization ensured clear sector-wise segregation and facilitated seamless access throughout the analysis process. Following collection and organization, all sustainability reports were systematically imported into Orange software.

Corpus Viewer Implementation

The Corpus Viewer stage represented a critical phase in the analysis workflow, serving as the primary interface for initial document inspection and quality assurance. Upon loading the documents into Orange's Corpus Viewer, each report underwent a preliminary examination to ensure proper text extraction and formatting. This stage was particularly crucial as it allowed researchers to identify any potential issues with

character encoding, document structure, or content integrity before proceeding with more detailed analysis.

Text Preprocessing Implementation

The text preprocessing stage constituted a critical step in preparing the dataset for analysis, ensuring consistency, noise reduction, and semantic relevance. Following initial cleaning procedures, all text was converted to lowercase to eliminate case sensitivity, while HTML tags, URLs, and special characters were removed to extract clean textual content. Tokenization was then applied to segment the text into individual lexical units. For lexical normalization, lemmatization was employed instead of stemming, as it preserves the contextual meaning of words by reducing them to their linguistically valid base forms (e.g., "reported," "reporting," and "reports" to "report"), which is particularly important in the context-sensitive domain of ESG disclosures. To further refine the corpus, a two-stage stopword removal strategy was implemented. First, standard English stopwords (e.g., "the," "and," "of") were removed using a predefined lexicon. This was complemented by a comprehensive domain-specific stopword list developed through iterative corpus inspection. This custom list included frequently occurring but analytically redundant financial and accounting terms (e.g., debt, loan, liability, equity, revenue, cost, income), corporate governance and reporting terminology (e.g., director, board, subsidiary, audit, report, annual), generic business terms (e.g., company, service, market, project, management), units and financial scales (e.g., crore, lakh, million, financial year indicators such as FY15–FY23), company names and proper nouns (e.g., Tata, Adani, Bharti, Ultratech, TCS, Nestlé), as well as formatting artifacts, URLs, and OCR-generated noise (e.g., "com," "https," "doi," "yyyy," and other non-semantic tokens). Temporal markers such as months and repetitive structural words were also removed. Special attention was given to numerical data, where a context-sensitive filtering approach was adopted. Isolated numeric tokens and formatting artifacts were removed, while numbers embedded within meaningful ESG-related expressions (e.g., emission targets such as "net-zero 2050") were retained to preserve analytical relevance. Regular expressions were systematically employed to identify and eliminate noise patterns, standardize textual structures, and ensure consistency across documents. This comprehensive preprocessing pipeline ensured that the resulting corpus was clean, semantically meaningful, and suitable for robust frequency-based and thematic analysis.

Analysis and Visualization

Following the preprocessing stage, the analysis phase implemented a three-track analytical approach to comprehensively examine ESG reporting patterns. First, sector-wise analysis identified specific trends and thematic patterns within each of the ten industry sectors, revealing distinctive ESG reporting characteristics and priorities across different business domains. Second, temporal analysis tracked reporting evolution from 2015 to 2023, documenting significant shifts in corporate sustainability focus over the eight-year period. Third, overall analysis synthesized findings across all sectors and years, determining overarching themes and insights across the entire dataset. Word clouds were generated that transformed preprocessed text data into visual

representations highlighting key themes and patterns in sustainability reports. This process involved careful technical configuration to ensure meaningful results, including implementation of a minimum frequency threshold of 1000 occurrences to focus on significant terms. Visualization parameters were meticulously adjusted, with size and color attributes optimized for visual clarity and interpretability. Separate word clouds were generated for each sector, temporal frame, and overall corpus, enabling detailed comparative analysis of sector-specific, temporal, and overall reporting patterns. Each word cloud was systematically documented, including detailed records of generation parameters and analytical context to ensure research reproducibility and methodological transparency.

Data Table Creation

The data table creation stage involved organizing the processed textual data into structured, analysable formats. This phase was crucial for enabling quantitative analysis of the qualitative data extracted from sustainability reports. Statistical summaries were generated for different analytical levels, including sector-wise comparisons, temporal trends, and ESG component analysis. These tables formed the foundation for subsequent statistical analysis and pattern identification.

Data Export and Documentation

The final stage focused on preserving the processed data and ensuring research reproducibility. All processed data was exported in multiple formats to ensure accessibility and long-term usability. The author created comprehensive documentation of the entire analysis process, including detailed descriptions of methodological decisions, processing parameters, and analytical procedures. The documentation included workflow diagrams, processing logs, and detailed descriptions of any modifications or special handling procedures implemented during the analysis. This thorough documentation ensured that the research process was transparent and reproducible while also providing valuable context for interpreting the results.

Keyword Selection, ESG Categorization, and Analytical Approach

To ensure analytical rigor and conceptual clarity, the study adopted a systematic approach to keyword selection and ESG categorization. Keywords were identified using a hybrid deductive–inductive approach. Initially, a deductive framework was developed based on established ESG literature, regulatory guidelines (such as Business Responsibility and Sustainability Reporting, BRSR), and prior keyword dictionaries used in sustainability and corporate disclosure studies. This provided a theoretical foundation for classifying terms into Environmental, Social, and Governance dimensions. Subsequently, an inductive refinement process was undertaken through iterative corpus exploration using Orange software, allowing frequently occurring and contextually relevant terms to emerge organically from the dataset. The final keyword taxonomy was then systematically mapped into the three ESG pillars. Environmental keywords included terms related to emissions, energy, climate, water, and resource efficiency; Social keywords captured themes such

as employee welfare, community development, diversity, health and safety; while Governance keywords encompassed board structure, compliance, ethics, risk management, and transparency. This combined approach ensured both theoretical grounding and data-driven validity, thereby enhancing the robustness and reproducibility of the classification process. The analysis primarily relied on frequency-based text mining techniques, including keyword frequency analysis and word cloud visualization, to identify dominant themes and their evolution over time. The objective of the study was exploratory in nature, focusing on uncovering patterns, trends, and shifts in ESG reporting narratives across firms and time periods (Abubakar & Umar, 2022; Dai et al., 2024). Accordingly, the analysis did not employ formal statistical hypothesis testing. However, to strengthen analytical depth, trend-based comparisons and cross-phase validation were incorporated, enabling systematic comparison of keyword prominence across the three identified phases (2015–2017, 2018–2020, and 2021–2023). This approach facilitated a more structured interpretation of temporal changes in ESG disclosure practices while maintaining methodological transparency.

FINDINGS

This section synthesizes the temporal evolution of sustainability and ESG reporting practices of NIFTY 500 companies over the period FY 2015–2023 by integrating insights derived from word clouds and keyword frequency visualizations (Figures 1–21). Rather than treating these figures as standalone visual artifacts, they are interpreted collectively to explain how corporate sustainability priorities in India have evolved in response to regulatory developments, stakeholder pressures, and exogenous shocks such as the COVID-19 pandemic. Overall, the longitudinal analysis reveals a clear progression in ESG reporting maturity, characterized by three distinct phases: initial establishment (2015–2017), governance consolidation (2018–2020), and balanced integration (2021–2023). The word clouds and frequency distributions across years provide visual and quantitative evidence of this transition from compliance-oriented disclosures toward a more integrated and strategically embedded ESG narrative. The three phases map closely onto dominant theories used to explain ESG and sustainability reporting. Bibliometric and review studies show that stakeholder, legitimacy, institutional, agency and signaling theories are the main lenses for ESG/CSR and integrated/sustainability reporting (Del Gesso & Lodhi, 2024; Freudenreich et al., 2019; Lakhani & Herbert, 2022; Sun et al., 2022).

In Phase I (FY 2015–2017), compliance oriented, governance heavy disclosure in an emerging market context fits legitimacy and institutional theory (Aureli et al., 2019; Baier et al., 2020; Bogdan et al., 2023; Bosi et al., 2022; Diwan & Sreeraman, 2023; Gupta & Motwani, 2022; Mishra & Sant, 2023; Naik et al., 2024; Rajan, 2025; Sharma et al., 2020; Yusof & Widyasamratri, 2025). Visual evidence from Figures 1 to 6 (word clouds and keyword frequency charts for FY2015–FY2017) highlights the dominance of governance-related terms such as business, profit, risk, reporting, and

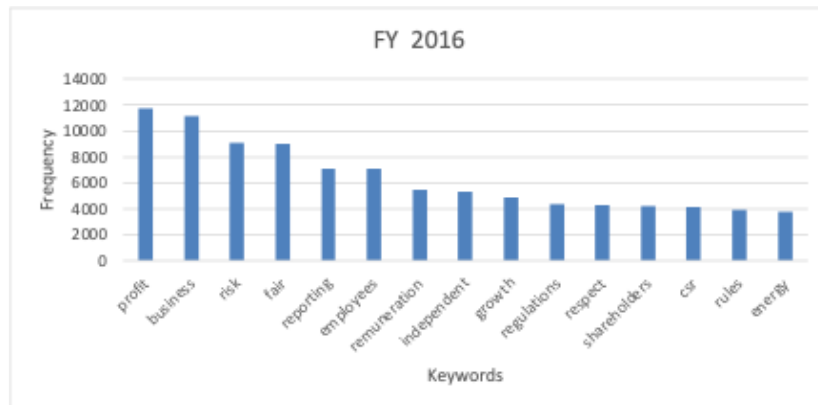


Figure 4. Top 15 keywords in FY 2016 derived from word cloud (Source: Authors' own elaboration)



Figure 5. Word cloud FY 2017 (Source: Authors' own elaboration, using Orange software)

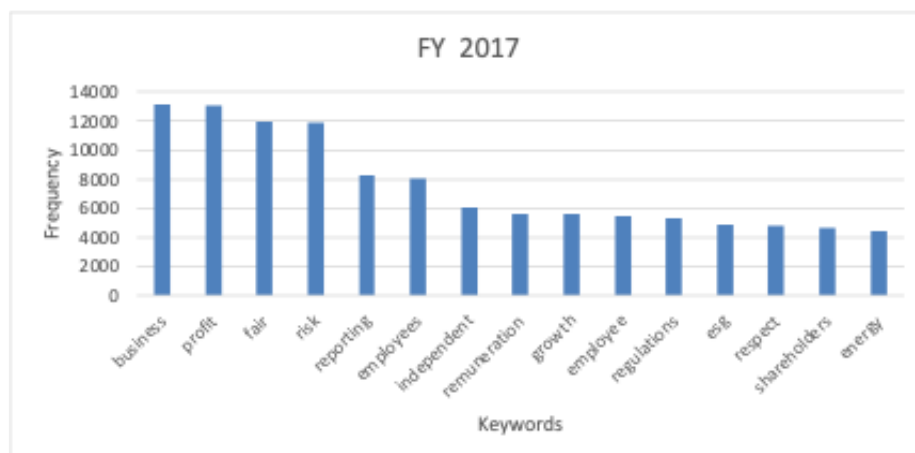


Figure 6. Top 15 keywords in FY 2017 derived from word cloud (Source: Authors' own elaboration)

Phase II (FY 2018–2020), marked by stronger governance, broader stakeholders and COVID 19 responsiveness (**Figures 7 to 12**), aligns with stakeholder theory, institutional theory and resource based/legitimacy perspectives (Ahmad et al., 2023; Amosh & Khatib, 2023; Beloskar & Rao, 2022; Chourasia & Pandey, 2025; Gonzaga et al., 2024; Khoury et al., 2022; Maji & Lohia, 2024; Marie et al., 2024; Pandey et al., 2023;

Singhania & Saini, 2021). The word clouds for FY 2018 and FY 2019 show a substantial increase in the frequency and dominance of governance-related terms such as business, risk, fair, independent, regulations, and reporting, echoing research that links Indian ESG practice to tightening regulatory norms, board independence and investor scrutiny (Ahmad et al., 2023; Chourasia & Pandey, 2025; Gonzaga et al.,

2024; Maji & Lohia, 2024; Marie et al., 2024; Pandey et al., 2023; Singhania & Saini, 2021). Mandatory ESG rules, sustainability frameworks and board characteristics are central antecedents of disclosure (Ahmad et al., 2023; Bosi et al., 2022; Del Gesso & Lodhi, 2024; Diwan & Sreeraman, 2023; Ellili, 2022; Khamisu & Paluri, 2024; Lokuwaduge & Heenetigala, 2017; Marie et al., 2024). The pandemic catalyzed ESG as a tool for resilience, risk management and investor demand, and intensified calls for harmonized, comparable standards, even

as “harmonisation” narratives were critically contested (Adams & Abhayawansa, 2021; Ahmad et al., 2023; Asif et al., 2023; Aqabna et al., 2023; Bai et al., 2024; Bodhanwala & Bodhanwala, 2023; Chopra et al., 2024; Diwan & Sreeraman, 2023; Khamisu & Paluri, 2024; Madaan et al., 2023; Marie et al., 2024; Pasupuleti et al., 2024; Singhania & Saini, 2021; Tyvonchuk, 2025).



Figure 7. Word cloud FY 2019 (Source: Authors' own elaboration, using Orange software)

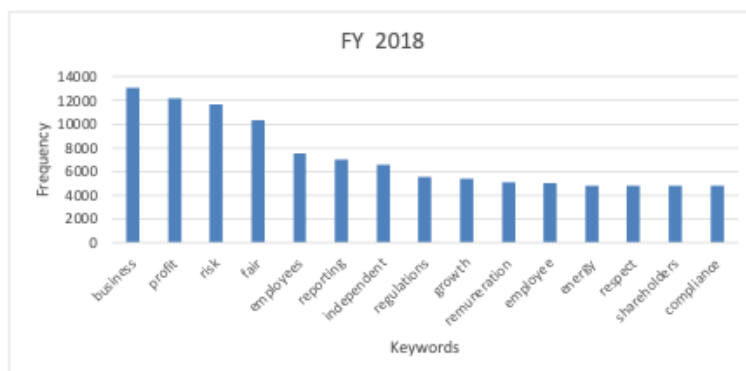


Figure 8. Top 15 Keywords in FY 2018 derived from word cloud (Source: Authors' own elaboration)



Figure 9. Word cloud FY 2018 (Source: Authors' own elaboration, using Orange software)

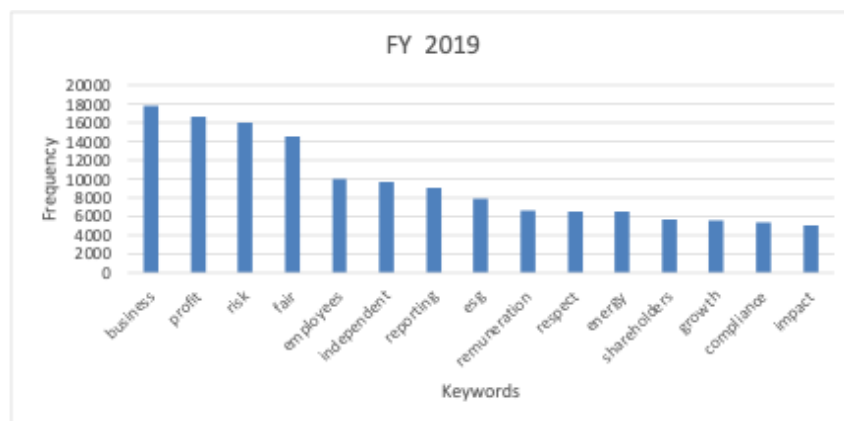


Figure 10. Top 15 keywords in FY 2019 derived from word cloud (Source: Authors' own elaboration)



Figure 11. Word Cloud FY 2020 (Source: Authors' own elaboration, using Orange software)

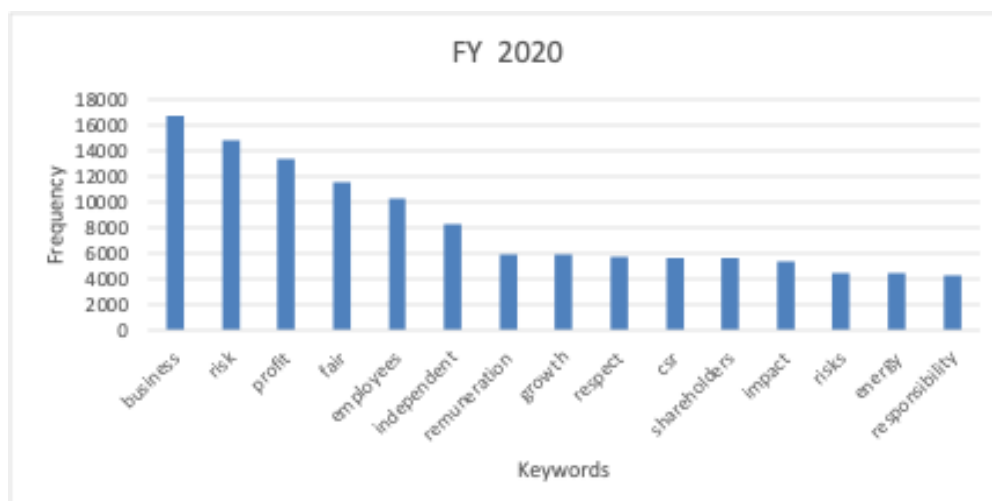


Figure 12. Top 15 keywords in FY 2020-21 derived from word cloud (Source: Authors' own elaboration)

In Phase III (FY 2021-23), ESG reporting shifts from standalone disclosures to strategically integrated practices, where sustainability is embedded within business models and value creation processes (**Figures 13 to 18**). The prominence of terms such as integrated and strategic indicates alignment of ESG with corporate strategy and financial performance (Adams & Abhayawansa, 2021; Chopra et al., 2024; Sun, 2024).

Firms increasingly incorporate ESG targets such as net-zero commitments and human capital development into core operations, reflecting a transition from symbolic compliance to substantive strategic transformation (Aldowaish et al., 2022; Annesi et al., 2024; Michalski, 2024). From a stakeholder perspective, social disclosures deepen through sustained emphasis on employees, safety, and training, indicating institutionalization of workforce practices and long-term

engagement (Madaan et al., 2023; Marie et al., 2024). Simultaneously, environmental reporting becomes more climate-specific and metrics-driven, with growing focus on carbon, emissions, and renewable energy, supported by evolving regulatory frameworks such as BRSR and global standards (Diwan & Sreeraman, 2023; Singhania & Saini, 2021; Tyvonchuk, 2025). Importantly, this phase reflects balanced and strategic integration, where governance, social, and environmental dimensions operate in a more interconnected manner. Studies mapping ESG integration find that the most recent phase is characterised by ESG as a

framework for resilience, risk management and long-term value creation, supported by dynamic capabilities, stakeholder and institutional theories (Almnadheh et al., 2025; De Souza Barbosa et al., 2023). ESG is framed as a strategic capability linked to organisational resilience, not just compliance (De Souza Barbosa et al., 2023). While governance remains dominant, the increasing depth and specificity of social and environmental disclosures indicate a shift toward institutional alignment and Resource-Based View (RBV) logic, where ESG capabilities function as strategic assets contributing to long-term competitive advantage (Liu, 2025; Suta et al., 2025).



Figure 13. Word cloud FY 2021 (Source: Authors' own elaboration, using Orange software)

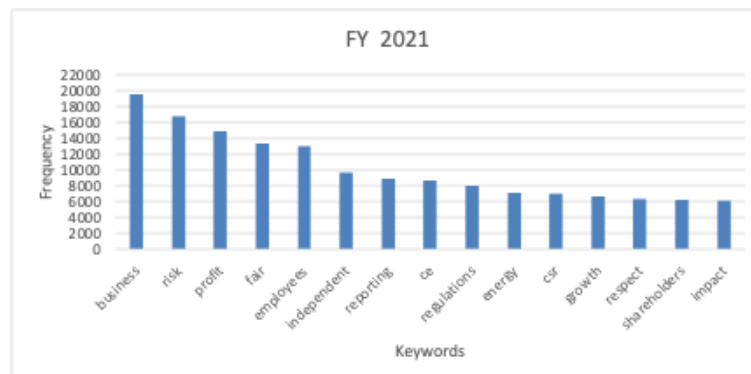


Figure 14. Top 15 keywords in FY 2021-22 derived from word cloud (Source: Authors' own elaboration)



Figure 15. Word cloud FY 2022 (Source: Authors' own elaboration, using Orange software)

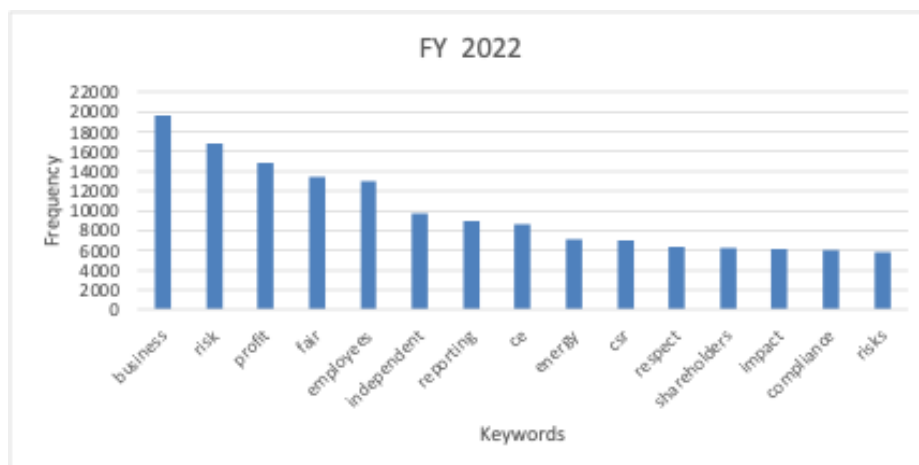


Figure 16. Top 15 keywords in FY 2022 derived from word cloud (Source: Authors' own elaboration)



Figure 17. Word cloud FY 2023 (Source: Authors' own elaboration, using Orange software)

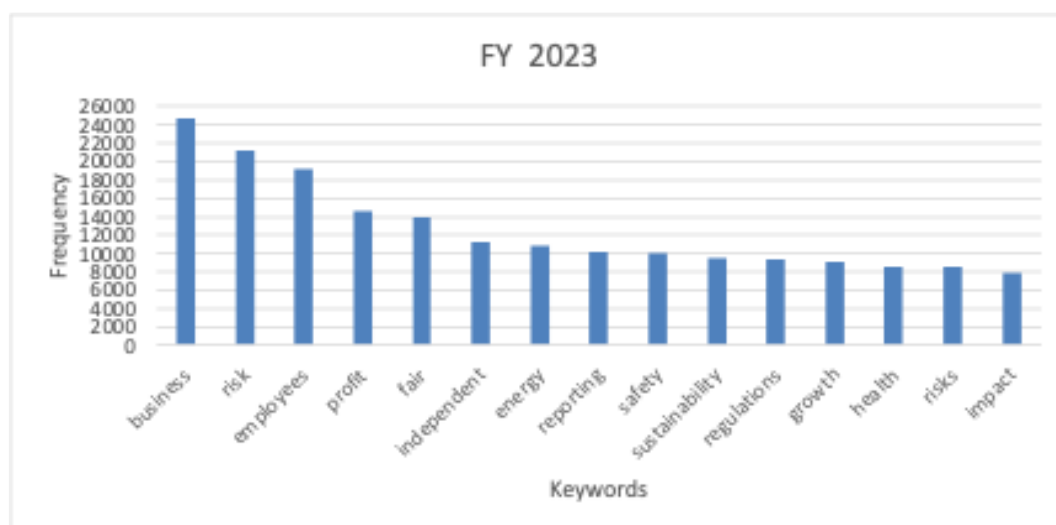


Figure 18. Top 15 keywords in FY 2023 derived from word cloud (Source: Authors' own elaboration)

The aggregate frequency visualization shown in **Figure 19**, consolidate and reinforce the year wise interpretations, consistent with evidence that ESG disclosure in India and other emerging markets has expanded in volume and complexity over time (Agarwala et al., 2023; Aggarwal et al., 2025; Maji & Lohia, 2022; Rajesh, 2020; Sharma et al., 2020). From a legitimacy and institutional theory perspective, this increasing volume and complexity reflects firms' adaptive responses to evolving regulatory expectations and normative pressures, as organizations seek to maintain legitimacy while aligning with formal ESG disclosure frameworks. **Figure 19** provides a longitudinal comparison of keyword frequencies, clearly illustrating the sustained dominance of governance related terminology alongside the gradual rise of social and environmental themes, paralleling findings that governance and social parameters tend to be more developed than environmental ones in Indian ESG performance and disclosure (Agarwala et al., 2023; Maji & Lohia, 2022; Rajesh, 2020; Shaikh, 2022). This dominance of governance discourse is

consistent with legitimacy theory, where firms prioritize governance mechanisms to signal accountability, transparency, and compliance to external stakeholders. **Figure 20** specifically highlights high frequency ESG terms across the entire period, confirming that business, risk, employees, energy, and sustainability serve as the backbone of ESG reporting narratives, in line with studies that identify governance (risk, management, shareholders), workforce issues, and energy/resource use as central pillars of ESG communication and performance in Indian firms (Agarwala et al., 2023; Mishra & Sant, 2023; Rajesh, 2020; Shaikh, 2022; Sharma et al., 2020). From a stakeholder theory perspective, the prominence of employee and social-related terms reflects firms' increasing orientation toward addressing the expectations of a broader set of stakeholders beyond shareholders, including employees, communities, and regulators. **Figure 21** further quantifies these patterns by showing the distribution of ESG components over FY 2015–2023, with governance accounting for 48.6%, social for 33.2%,



Figure 19. Frequency visualization in FY 2015-23 (Source: Authors' own elaboration, using Orange software)

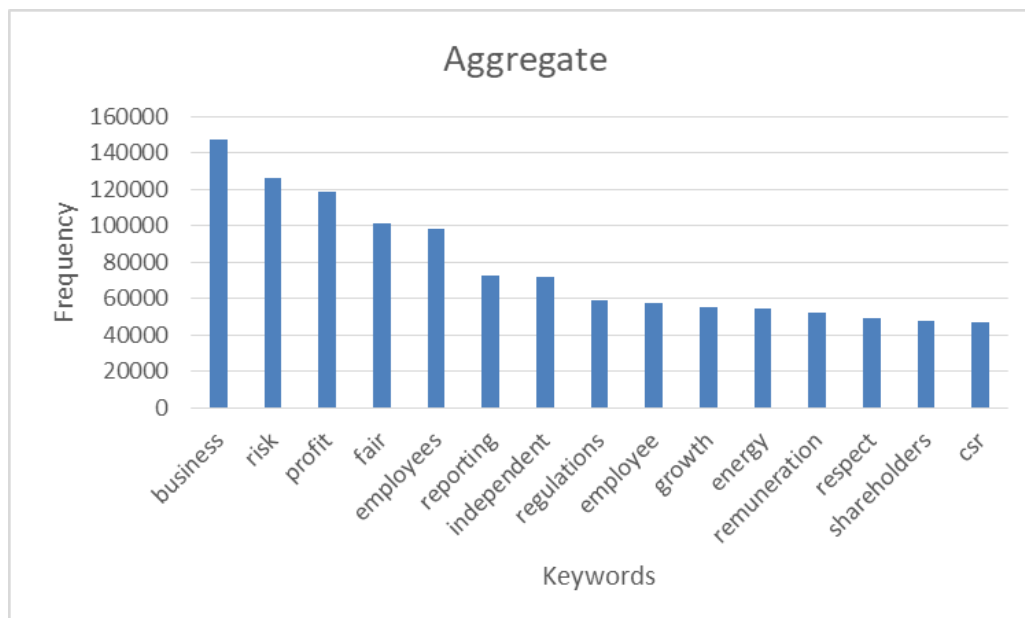


Figure 20. High-frequency ESG terms in FY 2015-23 (Source: Authors' own elaboration)

Environmental, Social and Governance Evolution (FY 2015-23)

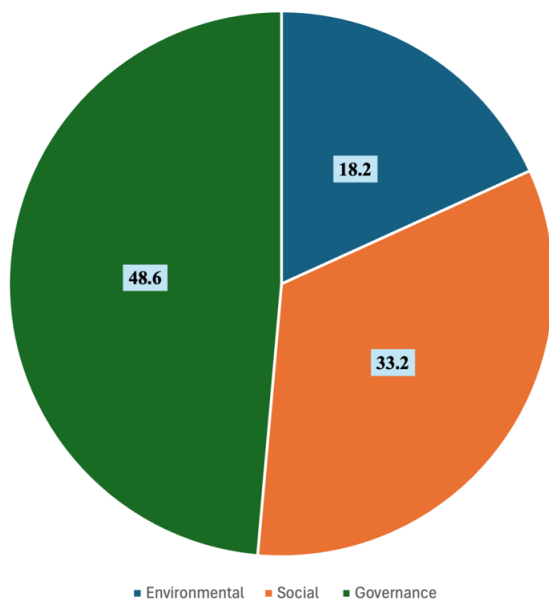


Figure 21. ESG component distribution in FY 2015-23 (Source: Authors' own elaboration)

and environmental for 18.2% of total ESG related content, which aligns with empirical evidence that Indian companies prioritize governance and social dimensions, while environmental integration—though improving, remains relatively nascent compared to other pillars (Maji & Lohia, 2022; Mishra & Sant, 2023; Rajesh, 2020; Shaikh, 2022; Sharma et al., 2020; Tsang et al., 2022). This imbalance can be further explained through institutional theory, where regulatory emphasis and compliance requirements have historically been stronger for governance disclosures, while environmental practices evolve more gradually due to higher implementation costs and longer gestation periods. This uneven maturity is echoed in broader emerging market research, where environmental disclosure often lags due to higher costs, longer time horizons, and weaker regulatory pressure (Adardour et al., 2025; Campanella et al., 2020; Gerged, 2020; Wan et al., 2023). From a Resource-Based View (RBV), the gradual strengthening of environmental and social disclosures indicates the slow development of ESG capabilities as strategic resources that contribute to long-term competitive advantage. Taken together, **Figure 1** to **Figure 21** provide complementary visual and quantitative evidence that ESG reporting among NIFTY 500 companies has evolved from basic, compliance oriented disclosures to more structured, integrated, and strategically aligned narratives, mirroring documented trends of increasing ESG index scores, broader thematic coverage, and closer linkage between ESG and firm performance in India (Agarwala et al., 2023; Aggarwal et al., 2025; Maji & Lohia, 2022; Mishra & Sant, 2023; Rajesh, 2020; Roy et al., 2025; Shaikh, 2022; Sharma et al., 2020). This transition reflects a shift from legitimacy-driven disclosure toward stakeholder engagement and ultimately toward strategic ESG integration, consistent with RBV and sustainability-oriented theoretical frameworks. The word clouds capture shifts in emphasis and vocabulary, while the

frequency analyses substantiate these shifts numerically. Collectively, they reinforce the argument that Indian corporate sustainability reporting has deepened in scope and sophistication over time, albeit with persistent asymmetries across governance, social, and environmental dimensions, a pattern also observed in sector specific and cross country ESG disclosure studies (Bastidas et al., 2025; Rajesh, 2020; Singh & Patel, 2025; Shobhwani & Prakash, 2025; Swain et al., 2024; Quttainah, 2025).

DISCUSSION

The analysis of ESG reporting trends from 2015 to 2023 reveals a significant and structured evolution in corporate sustainability practices among Indian firms, reflecting a transition from compliance-driven disclosure to strategic integration. A dominant and persistent pattern across the study period is the prominence of governance-related disclosures. This finding aligns with legitimacy theory, where firms prioritize governance mechanisms such as risk management, compliance, and transparency to meet regulatory expectations and secure societal approval, particularly in the early stages of ESG adoption (Gupta & Motwani, 2022; Kumar & Firoz, 2022; Lokuwaduge & Heenetigala, 2017). Within the social dimension, employee-related disclosures emerged as the most salient theme, with mentions of “Employee/Employees” increasing substantially from 9,787 in 2015 to 19,217 in 2023. This shift reflects a gradual transition toward stakeholder theory, where firms expand their focus beyond shareholders to include employees, communities, and broader societal actors (Ahmad et al., 2023; Alsayegh et al., 2020; De Souza Barbosa et al., 2023; Molnár et al., 2025; Taliento et al., 2019). The increasing emphasis on workforce welfare, inclusion, and engagement suggests that firms are responding to stakeholder pressures while simultaneously recognizing human capital as a critical driver of long-term value creation. Empirical evidence further supports that stronger environmental and social performance contributes positively to financial outcomes, reinforcing the shared value perspective (Ahmad et al., 2023; Alsayegh et al., 2020; Taliento et al., 2019). In contrast, environmental disclosures, while growing in absolute terms, remained proportionally lower throughout the study period. Energy-related terms dominated this category, with mentions rising from 3,812 in 2015 to 10,822 in 2023. However, the emergence of more advanced terms such as “emissions,” “climate,” and “conservation” in later years indicates a gradual deepening of environmental awareness. This evolution can be interpreted through an institutional theory lens, where increasing regulatory pressures and formal institutional mechanisms drive firms toward more structured and standardized environmental reporting practices (Gupta & Motwani, 2022; Lei & Yu, 2023; Lokuwaduge & Heenetigala, 2017). The temporal progression of ESG reporting reveals three distinct phases: Initial establishment (2015–2017), governance consolidation (2018–2020), and balanced integration (2021–2023). In the initial phase, ESG disclosures were largely symbolic and compliance-oriented, consistent with legitimacy and signaling perspectives, where firms sought to align with

emerging regulatory expectations and manage external perceptions (Gupta & Motwani, 2022; Kumar & Firoz, 2022; Lokuwaduge & Heenetigala, 2017). The governance consolidation phase reflects stronger institutional pressures and investor-driven expectations, where governance structures were emphasized as mechanisms for risk control and accountability (Gupta & Motwani, 2022; Li et al., 2021; Lokuwaduge & Heenetigala, 2017; Sharma et al., 2020). In the most recent phase, the convergence of environmental, social, and governance dimensions suggests a shift toward Resource-Based View (RBV) logic, where ESG capabilities are increasingly treated as strategic resources that enhance competitive advantage and long-term firm performance (Ahmad et al., 2023; Alsayegh et al., 2020; Bhandari et al., 2022; Chen et al., 2023; De Souza Barbosa et al., 2023). The observed evolution also highlights a broader shift in corporate narratives—from fragmented and compliance-driven disclosures to more integrated and strategically aligned ESG communication. The increasing interlinkages between ESG dimensions indicate that firms are beginning to internalize sustainability as a core component of business strategy rather than a peripheral reporting requirement. This aligns with emerging literature suggesting that ESG integration contributes to both financial performance and stakeholder value creation (Ahmad et al., 2023; Alsayegh et al., 2020; Taliento et al., 2019). Overall, the findings suggest that ESG reporting in India is undergoing a maturation process, transitioning from legitimacy-seeking behavior to institutional conformity and ultimately toward strategic resource integration. This progression reflects the combined influence of regulatory developments, stakeholder expectations, and competitive dynamics, demonstrating how legitimacy, stakeholder, institutional, and resource-based perspectives interact over time to shape ESG disclosure practices.

CONCLUSION

ESG has been gaining significant momentum in recent times due to increasing awareness among investors regarding investment returns and impacts. In this study, we conducted an in-depth analysis of sustainability reports from corporations listed in the NIFTY 500 index (2015–2023). A text mining approach was utilized using Orange software to analyze temporal trends in ESG reporting practices. The findings indicate a clear evolution in ESG reporting among NIFTY 500 companies, characterized by three distinct phases. During the initial establishment phase (2015–2017), companies began structuring their sustainability disclosures with governance dominating, followed by social and environmental considerations. The governance consolidation phase (2018–2020) saw governance aspects peak as companies responded to increasing regulatory pressures and the pandemic's emergence. Most recently, the balanced integration phase (2021–2023) demonstrates a more equitable approach, with governance moderating and social considerations rebounding. Throughout all periods, governance-related terminology (“business,” “profit,” “risk”) consistently dominated, while employee-focused terms led social disclosures, and energy-related language prevailed in

environmental reporting. However, the sophistication and specificity of terminology across all ESG dimensions showed marked improvement over time, reflecting the growing maturity of corporate sustainability thinking. The COVID-19 pandemic served as a significant catalyst, accelerating existing reporting trends while prompting companies to emphasize risk management, business resilience, and employee welfare. Post-pandemic reporting shows greater attention to social factors and more strategic integration of sustainability considerations into core business practices. The results indicate that the evolution of ESG reporting has been driven primarily by regulatory requirements and stakeholder demands. Companies have progressed from compliance-focused reporting to more strategic approaches that recognize sustainability as integral to business success. The findings suggest that while significant progress has been made, there remains a need for enhanced environmental reporting and more balanced attention across all ESG dimensions. This research indicates that companies should follow international standards for sustainable development and that better sustainability reporting frameworks are needed.

IMPLICATIONS

The findings provide valuable insights that may be used by policymakers, companies, investors, and educational institutes. From a policy perspective, the findings indicate that the Business Responsibility and Sustainability Reporting (BRSR) framework has been effective in standardizing ESG disclosures and encouraging firms to move beyond symbolic compliance toward more structured and strategic reporting practices. However, the continued dominance of governance-related disclosures, along with comparatively weaker environmental reporting, highlights the need for further regulatory refinement. This includes clearer sector-specific guidelines and stronger enforcement mechanisms. Policymakers may also consider integrating outcome-oriented ESG metrics and mandating third-party assurance to enhance the comparability, credibility, and substantive impact of sustainability reporting.

For companies, the findings provide valuable insights to strengthen sustainability reporting practices and align them with strategic decision-making. Firms are encouraged to move beyond compliance-driven reporting and adopt a more integrated and performance-oriented ESG approach. Leveraging emerging technologies can further improve ESG data collection, analysis, and reporting, thereby enhancing transparency and long-term sustainability outcomes.

For investors, improved ESG disclosure frameworks such as BRSR enhance the availability, reliability, and comparability of sustainability-related information. This enables more informed investment decisions and better assessment of firms' long-term value, risk exposure, and sustainability performance. As ESG integration becomes central to investment strategies, high-quality disclosures can strengthen investor confidence and capital allocation efficiency.

The findings also carry important educational implications. They highlight the need to integrate ESG disclosure theories into curriculum design, enabling students

to understand the drivers of sustainability reporting. Additionally, incorporating ESG analytics, text mining, and real-world case-based learning can bridge the gap between theory and practice in business and accounting education. Furthermore, executive training programs should adopt a balanced approach that combines compliance-focused reporting skills with transformative sustainability thinking.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This research is subject to certain limitations that provide avenues for future investigation. First, the study relies on the availability and quality of publicly disclosed sustainability reports, which may vary significantly across firms in terms of depth, transparency, and reporting standards. While the sample focuses on 269 companies from the NIFTY 500 index, the findings may not be generalizable to smaller firms, unlisted entities, or organizations operating in different international contexts. In particular, ESG practices of resource-constrained or emerging enterprises may not be adequately captured within this dataset. Second, although the study spans multiple sectors, it does not explicitly control for sectoral heterogeneity. As a result, the proposed phase-based model may not uniformly capture sector-specific dynamics, thereby limiting its explanatory scope across diverse industries. Third, from a methodological perspective, the study primarily employs frequency-based text mining techniques, including keyword analysis and word cloud visualization. While these methods are well-suited for longitudinal exploratory analysis, enabling intuitive identification of dominant themes and temporal shifts in large textual corpora, they remain relatively basic compared to more advanced approaches such as topic modeling or transformer-based language models. Consequently, the analytical depth may be constrained in capturing nuanced semantic relationships, contextual variations, and latent thematic structures within ESG disclosures. Additionally, the reliance on predefined and iteratively refined keyword sets introduces a degree of subjectivity, as results may be influenced by keyword selection, corpus construction, and contextual interpretation. Variations in reporting styles, terminologies, and disclosure practices across firms further affect the consistency and comparability of extracted insights. Future research can address these limitations in several ways. Expanding the sample to include firms from multiple indices, as well as small and medium-sized enterprises and unlisted firms, would enhance the generalizability of findings. Incorporating sector-specific analyses would allow for a more nuanced understanding of industry-level ESG dynamics. Methodologically, future studies could integrate advanced natural language processing techniques such as topic modeling, sentiment analysis, or deep learning-based embeddings to uncover latent themes and improve analytical depth. Furthermore, combining qualitative text-based insights with quantitative ESG metrics, financial performance indicators, and alternative data sources would strengthen the robustness of findings. Finally, cross-country and cross-cultural comparative studies would provide deeper insights

into how regulatory environments, institutional pressures, and socio-economic contexts shape the evolution of ESG reporting practices.

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Ethical statement: The authors stated that the study is based exclusively on secondary data collected from publicly available sustainability reports, ESG reports, CSR reports, Business Responsibility Reports (BRR), and Business Responsibility and Sustainability Reports (BRSR) published on the official websites of NIFTY 500 companies for the period FY2015–FY2023. No human participants, personal interviews, surveys, experiments, or confidential/private data were involved in the study. Therefore, ethical committee approval, informed consent, and participant consent were not required for this research. The study utilized only publicly accessible corporate disclosures and maintained confidentiality and ethical standards throughout the research process.

AI statement: The authors stated that no generative AI tools or services were used in the preparation of this manuscript.

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