

Evaluating Green Supply Chain Practices in Southeast Asia: A Text Mining Approach on Corporate Sustainability Reports

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Abstract

This study addresses the growing imperative for environmentally responsible supply chain management in Southeast Asia and the challenges of assessing corporate sustainability disclosures. Although companies increasingly produce sustainability reports, the extent to which these documents reflect genuine green practices remains unclear. This research systematically evaluates how five major Southeast Asian firms, including Unilever SEA, Nestlé Indonesia, Indofood, Danone, and ThaiBev, articulate green supply chain initiatives in reports published between 2022 and 2023. Employing a qualitative exploratory design, the study integrates document analysis with text mining and thematic coding; approximately 33,000 words from the five reports were processed, yielding 1,300 occurrences of green supply chain terms categorized into three themes: eco-packaging, green logistics, and carbon tracking. The results reveal a pronounced imbalance: eco-packaging comprised 54 percent of keywords ($n = 702$), green logistics 29 percent ($n = 377$), and carbon tracking 17 percent ($n = 221$). Unilever's 9,300-word report contained 350 mentions of eco-packaging, while Danone's 5,900-word report featured 310; carbon tracking averaged under 45 references per report. The study introduces a replicable text mining framework for ESG disclosure analysis and underscores the need for more balanced reporting, including Scope 3 emissions data. Future mixed-method approaches that combine computational analysis with qualitative validation are advocated. The findings provide evidence for policymakers and investors to refine ESG guidelines and highlight the potential of computational tools to enhance corporate accountability in sustainability reporting.

Keywords: *Green Supply Chain, Sustainability Reporting, Text Mining, ESG Disclosure, Southeast Asia*

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I. INTRODUCTION

Greatly increases the pressure on global supply chains to align their operations more clearly with Environmental, Social, and Governance (ESG) approaches. Sustainability is becoming increasingly important to consumers, investors, and regulators. They all compel companies to incorporate "green" practices throughout the supply chain from sourcing to production and across distribution networks. This has been quite observable in Southeast Asia, where transnational companies are increasingly spelling out their commitments to sustainability in formal documentation, especially under the banner of sustainability reports. The reports are expected to depict how various practices are pursued and also measured concerning the progress made towards environmentally responsible supply chains. The question, however, is how authentic, reliable, or exhaustive these reports are in rendering what happens in practice. The more matters

of green-washing raise their ugly heads, the more compelling will be reasons to pry open corporate disclosures' assessment of how things are going with green supply chain practices.

At present, many businesses worldwide have started forcing their supply chains to comply with ESG pressure conditions into their operational practices in terms of scope and primarily in metrics such as transparency and accountability. Today, businesses across the world undergo a transition to being more green through the sourcing, production, and distribution process for the alignment with sustainability objectives. (Raman et al., 2023) show how much evolution green supply chain practices have undergone with time; however, the assessment mechanisms for their real-world implementation remain underdeveloped. Similarly, (Zervoudi et al., 2025) mention that many business narratives about sustainability are not credible since the reality does not often match the claims. Moreover, (Wiegand & Wynn, 2023) recognize that despite the high number of firms that prepare sustainability reports, the same are often very dissimilar in structure and content, hence making cross-company comparisons nearly impossible. Lastly, (Ursino et al., 2025) state that documentary evidence is fundamental to evaluating whether firms indeed incorporate the ESG principles into their supply chains or merely indulge in symbolic disclosure.

Many important studies have done extra work in understanding the sustainable supply chains. However, much focus has been based on manufacturing practices or on understanding the regulatory framework of these systems without a direct analysis of corporate sustainability postings for the study. For instance, (Santoso et al., 2022) and (Barakat et al., 2023) studied the implementation of green logistics in the manufacturing sector, but they didn't analyze whether their practices would be used in the corporate documentation. The same gap can be cited in (Poiriazi et al., 2025), who probed the relationship of ESG regulations and supply chain strategies but did not assess transparency and narrative quality in sustainability reporting. Moreover, the research conducted by (Chen, 2024) and (Martiny et al., 2024) only considered particular industries and single-country contexts, and hence their study outcomes are very much limited in terms of generalization across the ASEAN region. Up to now, no study has done a text mining approach involving comparative analysis of sustainability reports of companies across more than one country in Southeast Asia. Hence, this study, under the title *Evaluating Green Supply Chain Practices in Southeast Asia: A Text Mining Approach on Corporate Sustainability Reports*, intends to address this critical gap for offering an approach to computer-based analysis that would extract and categorize, then analyze how companies represent their green supply chain initiatives using formal ESG disclosures.

This study aims to systematically identify the narratives and practices of sustainable supply chain management as reflected in corporate sustainability reports across Southeast Asia. The research

employs a text mining approach to reveal the different kinds of explicit commitments made by companies and the themes and language they used to communicate their green initiatives. The study will focus on exploring the extent of actionable and measurable green supply chain practices that companies in Southeast Asia will reveal in their sustainability reports. It, too, identifies trends, omissions, and industry-specific gaps in the adoption of green practices, making apparent the health beyond where sustainability reporting would usually stop. Thus, through comparative analysis, the study is expected to serve the interests of policymakers, investors, and corporate actors in the region in knowing how state-of-the-art the ESG transparency is in the region. Ultimately, it is intended that such an investment would make possible the formulation of more standardized and effective communication frameworks for sustainability under a larger agenda for environmental and supply chain governance.

II. LITERATURE REVIEW

A. *Conceptual Foundation*

1. Conceptual Framework and Strategic Implementation of Green Supply Chain Management

The Green Supply Chain Management (GSCM) is a multidimensional initiative, judiciary, and social order that propagates eco-responsibility within the entire supply chain from sourcing to disposal at the end of life. The whole idea is about moving away from cost-driven logistics to a balancing act concerned with ecological concerns. Such schemes may take the form of green procurement, energy-efficient transportation, and sustainable packaging methods. Also, according to (Nazir et al., 2024), GSCM contains a strategic set of practices that would minimize environmental impact without any detriment to productivity and economic value. Its principles call for an organization to reshape its understanding of supply chain objectives so that environmentally responsible practices are not treated as separate initiatives but are ingrained within core business processes. Such a theoretical framework would become more relevant as international apprehensions about sustainability improved, giving the organizations an avenue to assess and design their green supply systems.

A successful GSCM implementation often implies that the company rallies supply chain partners around common sustainability goals. This entails not only harmonizing internal policies but also establishing collaborative practices cascading down their supplier network. Partnerships that emphasize transparency, green performance metrics, and joint accountability nurture environmental improvement throughout the chain. (Sherif et al., 2022) remark that such advanced strategic implementation is noted to occur in firms that face more stringent environmental regulations, where structured frameworks and environmental Key Performance Indicators (KPIs)

are widely adopted. Therefore, both internal governance and external cooperation are instrumental to promoting green initiatives in the supply chain. Inter-organizational trust comes to the forefront as a facilitating factor for the extended application of these environmentally aligned strategies.

As GSCM becomes increasingly relevant, corporate sustainability reports have become of primary importance for disclosing environmental strategies and results. It is expected that such reports document qualitative commitments and quantitative metrics relevant to their environmental performance. Disclosing practices can, however, exhibit inconsistency in cases where reporting standards are voluntary. (Hamilton & Waters, 2022) claim sustainability reporting is often used for public relations purposes rather than for verifying environmental performance. This creates a situation in which green supply chain activities are hard to benchmark or compare across firms and industries: for any reporting system, these variations render such comparisons unreliable. Moreover, adopting an unstandardized format allows companies to cherry-pick their reporting such that it may celebrate successful initiatives, while less fortunate or still-in-development areas may be omitted from it altogether.

The influence of the regional context shapes the GSCM reporting in terms of character and transparency. Culturally-based issues, regulatory infrastructures, and economic maturity are among the factors that shape the operationalization and communication of green initiatives. In a comparative study conducted in different economies, (Haleem et al., 2022) discovered that organizations in developed economies tend to adopt more rigorous and detailed environmental reporting, driven by stakeholder pressures and institutional requirements. As a linear opposite, organizations in emerging markets, facing issues such as limited resources or a less stringent regulatory environment, may choose not to disclose so much. Findings emphasize the significance of contextual factors for GSCM evaluation, especially in those areas where rapid industrial development is following increased sustainability expectations, as in Southeast Asia.

2. Text Mining Approach in ESG Analysis

Text mining as an analytical technique in ESG analysis matured with the surging number of unstructured data, embedded into the company sustainability reports. This narration, rather often, contains qualitative data that are difficult to glean with conventional analytical tools. (Gutierrez-Bustamante & Espinosa-Leal, 2022) assert that text mining reveals underlying trends and semantic structures from these documents that enhance the interpretability and comparability of ESG reporting. With natural language processing, researchers correlate many language features with some key ESG dimensions like climate disclosures or ethical procurement, whereby this opens a scalable avenue compared to human manual content analysis, where the work in analyzing

large datasets across various industries or geographical locations is concerned. The structured output, defined using computational techniques, fosters more transparent evaluation and data-driven assessments.

Thematic and sentiment analysis have become essential tools in ESG text mining to illuminate the way companies articulate their environmental and social commitments. As indicated by (Kumar Nallapaneni et al., 2023), methods such as frequency and co-occurrence reveal dominant themes of ESG, covering concepts like "carbon neutrality" or "stakeholder value," valid perhaps as reflections of wider industry or regulatory trends. The same methods can longitudinally trace shifts in language to ascertain whether a company pushes forward, stands still, or pulls back on its sustainability message. Differences in tone and language can further reveal signals of organizational priorities and reputational strategies. These differentiations suggest that analysts employ insight gained from these searches to judge not only what companies report but also the way they report their commitments. This perspective is especially useful for comparative studies and benchmarking ES.

Topic modeling and clustering are important machine learning tools that have made major gains in precision and scale in ESG text analysis. (Ferencek et al., 2025) note that the unsupervised methodology can naturally classify a massive amount of sustainability data into coherent topics without adherence to already established taxonomies. Several regional biases or sectoral allowances can also be detected by these models. The most important just-in-time regulation seems to favor disclosures on supply chain transparency or carbon accountability in some geographies, while companies in developing economies tend to report more broadly on sustainability issues. Gastrointestinal tract patterning elucidates some of the interesting facets of corporate ESG narrative adaptation and evolution. Most importantly, these methodologies form a foundation for any systematic and comparative evaluations as ESG frameworks become increasingly complex.

Text mining is now being applied to several other ESG communication channels, including regulatory filings and sustainability ratings by multilateral organizations. (Cruz & Matos, 2023) emphasize that using automated processes helps assess the degree of alignment between the ESG content reported and the global frameworks, such as the UN Sustainable Development Goals (SDGs). The discrepancies between what is disclosed as the intention and how it is represented in the text often highlight gaps in the (intent generation and marketing) processes or narrative construction. By quantifying the linguistic trends over document types and periods, researchers are allowed to build a more subtle understanding of ESG coherence. This capacity would therefore facilitate longitudinal monitoring of sustainability commitments and make it easier for different

stakeholders to assess their progress. Given the rising expectations in ESG, the very analytical role of text mining will be gaining further prominence in sustainability discourse, both in theory and practice.

B. Previous Studies

1. Comparative Study of Sustainability Reporting between Asia and Europe

Asia's and Europe's paths of evolution in sustainability reporting have traveled through diversities due to different regulatory structures, institutional environments, and societal expectations. (Zatonatska et al., 2024) put it that, historically, European companies have always inclined themselves toward adopting more standardized reporting frameworks influenced by regulatory requirements of the European Union and public policy thrusts to these mandates. Their findings show that such organizations are most likely seen adopt comprehensive disclosure formats, such as the GRI and the Non-Financial Reporting Directive, which lead to the construction of reports emphasizing environmental performance and supply chain transparency. By contrast, companies in Asia tend to engage voluntarily and hence take wildly different forms and depths in the report. Such disparity emanates mainly from varying institutional maturity levels and cultural approaches to corporate transparency. The findings signal a structural division in the framing and communicating of sustainability accountability differently across these two regions.

In responding to sustainability phenomena, institutional theory has furnished us with a satisfactory frame of analysis for understanding how regional dynamics shape behaviors surrounding sustainability disclosure. (De Souza & De Souza, 2024) found that many Asian companies sustain their approaches to sustainability reporting in a compliance-oriented disposition influenced more by reputation and external pressure than by internalized ethical values. The authors contend that in countries such as Malaysia and Singapore, companies tend to disclose information reactively in response to either expectations from investors or signals from the government. This, however, is in contrast to how companies in Europe more likely treat sustainability as a strategic aspect with a long-term value creation perspective embedded in their corporate governance and stakeholder relationships. The different institutional contexts further designate different levels of stakeholder engagement as well as transparency in the regions. These regional contextual differences lead to lower levels of consistency and completeness of the ESG data reported.

Further empirical evidence demonstrated these distinctions at the regional level by accounting for the quality and comparability of disclosures in ESG. (Villacampa-Porta et al., 2025) Comparative research elaborated here demonstrated that in Europe, companies more often make public commitments to forward-looking ESG, measurable environmental targets, and third-party access

to audits of their data reported. In contrast, companies across Asia showed more inconsistency in the terms used for the reporting structure and the performance metrics, which complicates benchmarking across countries. These differences partly result from different understandings of materiality and sectoral priorities within each region. This study highlighted the need for caution in evaluative attempts on the global stage about sustainability performance because of the different approaches and reporting practices have at their foundations. Such a fragmented topography would continue to render difficult the establishment of universal tools for evaluating ESG.

Contrasting disclosure norms across regions are further evidenced by differences in narrative style and thematic focus in sustainability reports. (Mariani et al., 2022) reported that European firms embed issues of sustainability within the different contexts of corporate innovation, risk mitigation, and stakeholder dialogue. They take a strategic stance in addressing the sustainability agenda, which includes climate resilience, labor rights, and human capital development as a systemic issue. By contrast, sustainability for Asian companies often translates into philanthropy and regulatory compliance, couched in a rhetorical style glorifying corporate goodwill over systemic change. Such narrative divergences are intimately connected to culture as a larger force, including collectivist values with hierarchical business structures and PR-led communications. Accordingly, the interpretation and repercussions of ESG narratives diverge considerably in the two regions, sometimes despite superficially congruous reporting frameworks.

2. The Role of the Global Reporting Initiative in Environmental, Social, and Governance Disclosure

According to the Global Reporting Initiative (GRI), it offers basic standardized indicators and principles that take on describing a foundation for an accountability and transparency global reporting on the corporative pay. According to this publication by (Hsueh et al., 2023), GRI institutionalizes and gives formal stipulations to the manner in whereby companies articulate their environmental and social performances. Their research demonstrates the movement within the GRI framework as an incentive to encourage firms towards addressing a wide array of stakeholders' issues while promoting comparability within industries. The change from voluntary storytelling to measuring indicators by the legitimacy of sustainability could also be taken here. The GRI design enables companies to argue that they are consistent in their efforts in ESG, thus lessening accusations of being 'greenwashers' and increasing investors' and regulators' confidence.

In many countries, the GRI comprises national public policy in terms of a general approach towards using the GRI under further voluntary conditions. (Fuentes Henriques et al., 2022)

explain that broad expansion includes drafting government guidelines and institutional expectations as concerns sustainability disclosures. The reports published by GRI-oriented companies are very strong in evidence and consistent, and as such can easily be utilized across several markets. The voluntary-institutional alignment contributes towards the placement of ESG reporting at the strategic function rather than purely as a marketing tool. Findings point toward stronger stakeholder engagement by GRI compliance firms, given that structured disclosures improve communication between corporations and external entities.

Flexibility in design has always been a critical trait of GRI that encourages organizations to focus only on those matters that seem to be most material to their operations and stakeholders. (Pranugrahaning et al., 2023) state that this flexibility perhaps makes the GRI so applicable in all kinds of economies and regimes in terms of multi-national corporations handling sundry sustainability expectations. By the application of materiality and stakeholder inclusiveness principles, firms are in a position to prioritize their ESG issues depending on relevance rather than needing to apply a general checklist. Therefore, it gives more relevant information to its stakeholders, while also showing an evolved view of the company's understanding of ESG risks and opportunities. It has also helped investors on a level playing field across ESG disclosures, avoiding any highlighted emphasis on an issue.

This is in addition to the reporting consistency, and it has shown that the GRI framework can support computational analyses, for example, text mining and ESG benchmarking. (Suta et al., 2025) state that the well-structured language and consistent taxonomy applied in GRI reports allow for the automated extraction of ESG indicators. Such analytical compatibility enables the researcher and practitioner to handle huge volumes of sustainability disclosures and identify patterns across companies and sectors. Their study shows how the GRI increases the research usability of ESG data by making it readily available for more academic evaluation and policy analysis. As such, it is one of the most common frameworks used not just for corporate communication but also as a base for sustainability research in applied data science. Table 1 summarizes these various viewpoints about the GRI within their application context, thus showing the contribution of previous studies to the academic debate about ESG disclosure.

Table 1. Summary of Prior Studies on the Role of GRI in ESG Disclosure

Study	Key Findings	Contribution
(Hsueh et al., 2023)	GRI formalizes sustainability discourse and promotes cross-sector comparability	Legitimizes ESG reporting and reduces the risk of greenwashing
(Fuentes Henriques et al., 2022)	GRI adopted in public policy and industry strategies enhances consistency	Aligns voluntary reporting with institutional expectations
(Pranugrahaning et al., 2023)	GRI allows prioritization of ESG issues by stakeholder relevance	Supports relevance and balance across ESG dimensions

(Suta et al., 2025)	Structured GRI language enables scalable text mining and benchmarking	Enhances ESG data usability in sustainability research
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III. RESEARCH METHOD

The research design for this study is a qualitative exploratory research design, with document analysis as the principal methodological approach. The qualitative consideration of the current research lends itself to understanding corporate sustainability report narratives that are complex and context-specific, with particular reference to those narratives about environmental and supply chain disclosures. Such an approach involves a more nuanced textual examination of how companies communicate their sustainability commitments in largely non-numeric terms. The exploratory angle of this study seems apt given the complexities and flux of sustainability communication in Southeast Asia, with diverse institutional settings and cultural contexts intervening in the reporting practices there. Inattention is given in structured or metric-driven analyses to nuanced variations in language, framing, and emphasis on themes, which this approach is particularly good at catching.

The data for the current study comprises corporate sustainability reports from 2022 to 2024 from five of the largest companies operating in ASEAN: Unilever SEA, Nestlé Indonesia, Indofood, Danone, and ThaiBev. These large companies were selected because of their resonance in the region, active ESG reporting practices, and availability of their documents. All reports were downloaded from official company websites and institutional databases, such as the GRI or Sustainalytics, thus assuring a level of credibility and authenticity of the sources. Achieving comparability and relevance was ensured by selecting only those reports that comply with ESG standards, such as GRI, SASB, and TCFD, thereby providing a uniform basis for analysis. This condition also supports evaluating how standard frameworks shape the verbal and thematic structure of reporting.

The process of analysis has been characterized by several stages, which will eventually serve to help transform unstructured corporate sustainability documents into analyzable datasets. The first step conducted thus involved the gathering of reports reproduced in PDF form as an initial stage toward conversion into machine-readable text files that would permit their being processed digitally. This step had to become part of the whole exercise to ensure that there was compatibility with all the natural language processing tools needed in later stages. Again, it followed the series of text preprocessing steps, including text extraction, tokenization, and stripping of stopwords, punctuation, and irrelevant symbols. These procedures helped drown out the noise in textual data while making the language units being analyzed clearer and smoother.

The text would thus be prepared through a process of such preprocessing, ensuring that the computational methods that would be applied later would work on a clean and semantically meaningful set of data, hence raising the reliability of the findings. For example, Figure 1 enchains a flowchart that shows the chain of methodological steps applied in this research, starting from data collection and finally thematic analysis.

Research Flowchart

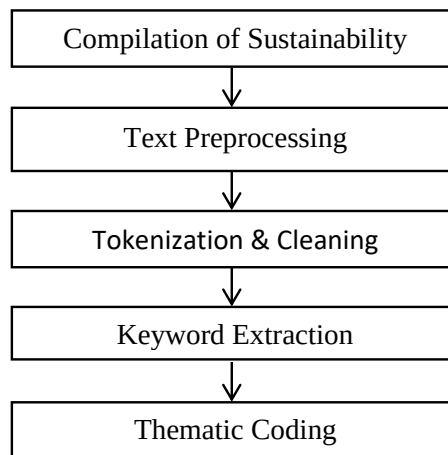


Figure 1. Research Flowchart of Text Mining-Based ESG Analysis

Next, text mining techniques, such as the AI-assisted keyword extraction, were used to identify prominent terms and recurring themes linked with sustainable supply chain practices among these reports. The objective of this step was to discern frequently referred-to concepts and expressions that the companies consider relevant in their sustainability discourse. The raw products thus obtained went through a process of thematic coding, which is a qualitative technique through which researchers can bring order to content through coherent classification. By this method, the coded data were distributed into three predefined themes: green logistics, eco-packaging, and carbon tracking-all widely reported in the literature as essential elements of GSCM. Since these categories were thus both anchored on existing theoretical propositions and further correlated with some recurrent patterns from the introductory keyword analysis, the integration of text mining and thematic coding provided a process definition in the light of interpreting corporate narratives while meeting the computational efficiency level with contextual depth.

A methodical approach, thus combining methods, enables the research to create strong empirical foundations for how sustainability is often communicated by different corporate actors in the ASEAN region. Such an analysis, mostly focused on textual reports, would seize nuances

and variations in language that purely quantitative studies would miss. Methodology allowed comparison between firms because the same methodology could be used to study how thematic intensity and keyword prominence are defined across companies. It also permitted the tracking of reporting patterns and stylistic differences that could connote industry or national influences on the discourses of ESG. Also, it allowed the construction of an extrapolating replicative model to study sustainability narratives, applicable to more regions or sectors in the future. This emphasis on systematicity and reproducibility thus intensifies the analytical rigor of the study and extends its possible contribution to ESG research.

IV. RESULT

A. Results

As a result of the analysis of sustainability reports produced by five major companies in Southeast Asia, the emphasis accorded to GSCM identified themes varied from company to company. The two-dimensional analysis, accompanied by text mining and thematic coding, brought forth three major categories, namely, green logistics, eco-packaging, and carbon tracking. Such issues are typical representations of economic aspects in corporate sustainability narratives and provide a useful methodological cue to the evaluation of the relative prominence of certain environmental practices. Based on the frequency of occurrence across many reports and alignment with international sustainability goals, the extracted themes were screened. A frequency comparison of each theme in a quantitative way by plotting is said to help reveal a better picture of how companies view these aspects of green supply chains in the future. A bar chart was then constructed to represent the frequency of each theme across the five companies, as depicted in Figure 2 for enhancement of intelligibility purposes.

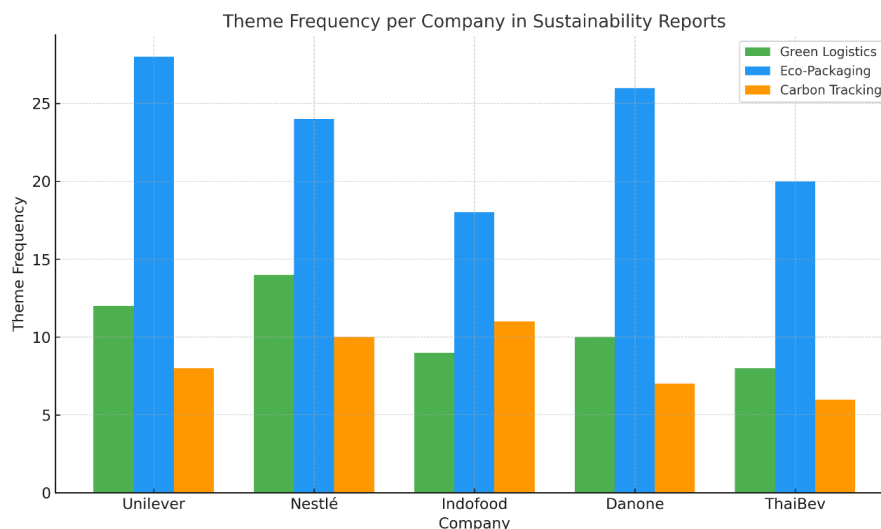


Figure 2. Theme Frequency per Company

In Figure 2, eco-packaging appeared as the most talked-about theme in most reports and especially in the cases of Unilever and Danone. This prominence may well indicate a strategic impetus towards packaging innovations subjected to mounting consumer scrutiny over environmental impacts and regulatory impetus to reduce plastic waste. The continuous focus on eco-packaging suggests that companies feel that redesigning packaging as an element in their sustainability strategy would be highly visible and easily controlled. On the contrary, themes like green logistics and carbon tracking appeared much less often, which could indicate operational challenges in their implementation or lower importance in the corporate strategic agenda. Amongst the five, Nestlé exhibited the highest fairness in the distribution of the three themes, signaling a more holistic approach to GSCM. As a different observation, it is worth noting that ThaiBev had a rather low frequency overall and particularly in carbon tracking, thus pointing to differences in reporting standards, allocation of resources, or different expectations in the beverage sector.

It's also a demonstration of how interpreting the variation in thematic scope could get to be made clear by creating a heat map visibly displaying the relative frequency of ESG themes for each particular firm. Hence, it enables a quick identification of the thematic dominances and comparisons across companies. The heat map is even closer to an actual practice in disclosure, wherein it typifies what domains are given continuous prominence and what remain less represented. The chart shows the different strengths in themes according to intensity, as well as possible gaps in communication within the chart, before finally translating into colors. This method enables a more nuanced interpretation of the sustainability discourse reflected in company reports. The outputs of this visualization are thus consolidated in Figure 3, which gives an overview of disclosure dynamics from five different companies.

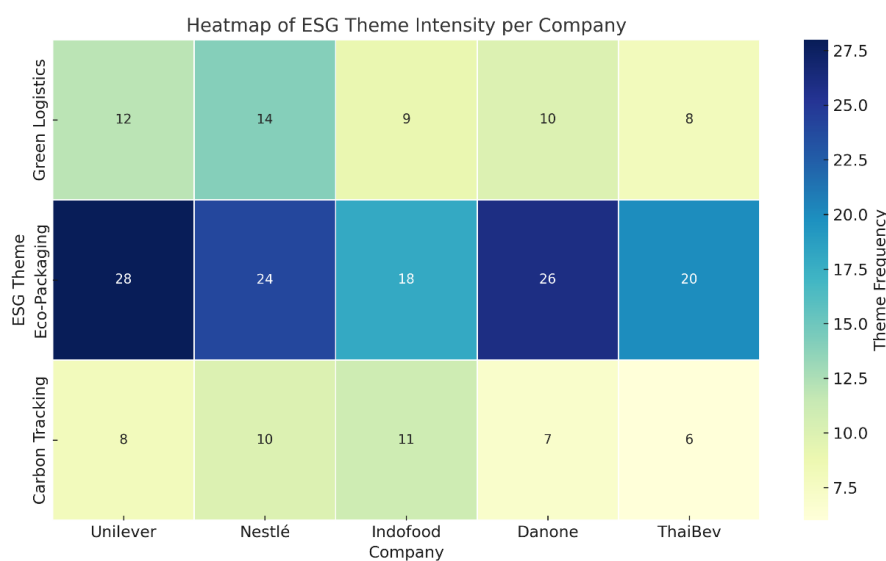


Figure 3. Heatmap of ESG Theme Intensity per Company

The following table, presented in Table 3, gives a detailed overview of the dataset used for this analysis concerning reporting year, country, and ESG standards applicable to each company. This dataset hence serves as an empirical basis for the study since it provides concrete information on the contextual scope of each sustainability report being examined. Reports regarding several Southeast Asian countries thus draw a huge representation of regional reporting practices. The interlacing of differing periods and frameworks strengthens the reliability of the comparison for both time and regulatory considerations. The ESG standard documentation, SASB, or some relevant national guidelines, gives insight into how the recognized frameworks impinge on how companies perceive and declare their environmental obligations. Thus, by rooting the analysis within this dataset, it renders the opportunity to further inquire not only into the thematics but also into the institutional-geographically divergency of corporate sustainability reporting within the region.

Table 2. Description of the Sustainability Report Dataset

Company	Year	Country	Word Count	Format	ESG Standards Followed
Unilever	2023	Indonesia	9,300	PDF	GRI, SASB
Nestlé	2022	Malaysia	7,800	PDF	GRI
Indofood	2023	Indonesia	6,200	PDF	GRI, TCFD
Danone	2023	Vietnam	5,900	PDF	GRI
ThaiBev	2022	Thailand	Not specified	PDF	Assumed GRI-compliant

The overall picture, however, is limited at this exploratory stage in conveying evidence of the scope to which large corporations in Southeast Asia have cloaked green supply chain activities within formal sustainability disclosure. The recurring themes that shape the corporate voice in an analysis also indicate the spectrum of variation associated with these themes across companies. The study, using the combination of both textual and visual data, shows what environmental practices are at the apex of ESG communication. The comparative angle of the findings then provides the resource for constructing a nuanced perspective on how firms talk sustainability to accommodate internal strategies, stakeholder expectations, and regulatory requirements. Where there is both convergence and divergence, the thematic emphasis is such that the issue becomes a central concern of corporate discourse, while another issue has been of less consistent attention. Such insights into progress have found greater depth in the understanding of how environmental communication has been changing in corporate Southeast Asia and set the stage for future research related to the effectiveness and credibility of ESG reporting practices.

V. DISCUSSION

The clear indications from this research are that eco-packaging stands as the most consistently reported green supply chain theme among the companies analyzed, and even though there are issues with carbon tracking and green logistics, the two are marginally represented. Such considerations have been framed by (Wiegand & Wynn, 2023) and (Zervoudi et al., 2025), who pointed out that sustainability disclosures have tended to serve more as symbolic means of communication than as credible windows into operational realities. The impact of this dominance of packaging disclosures may correlate with consumer visibility alongside the ease of exhibiting real progress with such endeavors, in unison with (Hamilton & Waters, 2022), who also argue about an emphasis on the highly marketable sustainability themes. The downplay of carbon tracking becomes more evident concerning the findings of this review, with (Ursino et al., 2025) having raised the issues around the inconsistency in the depth and structure of sustainability reporting, especially so in technically complex areas. These findings also strengthen the position taken by (Nazir et al., 2024) that the level of integration of green supply chains is often largely driven by external pressures surrounding regulation, which are known to be highly uneven across Southeast Asia. The very variable reporting depth and thematic distribution demonstrate yet again the challenge of aligning corporate communications with measurable environmental performance, especially in regions where ESG requirements are less strongly enforced.

The comparative analysis here reveals that even companies that adopt the recognized ESG standards, such as the GRI, differ in how they articulate similar themes, which states that merely adopting standards does not ensure uniformity in narrative framing. This observation corresponds to the statements by (Hsueh et al., 2023) and (Pranugrahaning et al., 2023) that the flexible materiality principle inherent in GRI allows companies to selectively highlight those topics that harmonize with their strategic image. The prominence of some themes in companies like Unilever and Nestlé reflects not only a maturity of institutions but also the engagement level of stakeholders, as noted by (Haleem et al., 2022), and the lesser frequency of ThaiBev's disclosures may be seen as resource constraints or lesser regulatory incentives in the home market. Further results vindicate the criticism by (De Souza & De Souza, 2024) and (Mariani et al., 2022) regarding the divergence in public expectations about the accountability and scrutiny differences resulting in regional differences in sustainability discourse. Although text mining offers a consistent basis for comparing themes, the variations in narratives suggest that qualitative interpretation, therefore, legitimizes the understanding of strategic intentions behind ESG disclosures. These findings add value to the understanding of the limitations of existing practices in reporting and support calls for increased standardization and third-party assurance mechanisms

to improve transparency and credibility surrounding sustainability communication in Southeast Asia.

VI. CONCLUSION AND RECOMMENDATION

Sustainability reporting, according to this study, has progressed in Southeast Asia in making narratives for GSCM visible. Some high-profile and easy areas are eco-packaging, while other complex domains, such as carbon tracking and green logistics, distance the findings in terms of emphasis. This shows that some areas are undersold on underreporting practices, which would require deeper operational openness. Text mining has proven to be an excellent means of targeting the evolution of themes and rhetorical focus within GSCM-related disclosures for gaining insight into overall corporate sustainability communication. Text mining alone cannot capture fully the qualitative depth of individual reports, but allows much more systematic and scalable comparisons across firms and sectors. This point emphasizes making consistent the narratives of sustainability with corresponding actual practices to enable actual reflective corporate disclosures from being mere symbolism.

For substantial improvement in the quality of green supply chain reporting, the study suggests general adoption of carbon accounting standards, insisting on Scope 3 emissions that are largely underreported regionally. These data capture indirect environmental risks related to the whole supply chain and generally make improvements in the visibility of sustainable practices in corporations. Future studies should combine document review with qualitative means of triangulating the findings, for instance, by interviewing supply chain managers or auditing internal reporting mechanisms. Widening such studies across industries and countries will, in addition, assert a higher generalizability of conclusions and sector-specific best practices. Cross-country comparisons would also shed more light on how regulatory frameworks and stakeholder expectations influence behaviors on sustainability disclosure. All these would ultimately contribute to creating a more open, fair, and credible environment for GSCM reporting in Southeast Asia.

REFERENCES

- Barakat, B., Milhem, M., Naji, G. M. A., Alzoraiki, M., Muda, H. B., Ateeq, A., & Abro, Z. (2023). Assessing the Impact of Green Training on Sustainable Business Advantage: Exploring the Mediating Role of Green Supply Chain Practices. *Sustainability*, 15(19), 14144. <https://doi.org/10.3390/su151914144>
- Chen, C. C. (2024). Comparative Impacts of Energy Sources on Environmental Quality: A Five-Decade Analysis of Germany's Energiewende. *Energy Reports*, 11(129), 3550–3561. <https://doi.org/10.1016/j.egy.2024.03.027>

- Cruz, C. A., & Matos, F. (2023). ESG Maturity: A Software Framework for the Challenges of ESG Data in Investment. *Sustainability*, 15(3), 2610. <https://doi.org/10.3390/su15032610>
- De Souza, M. C. S., & De Souza, R. S. (2024). Law Enforcement, Social Demands and Reputation Risks as Drivers of Compliance Functions: a Comparative Analysis of the Largest Banks' Disclosures in the UK and Brazil. *Crime, Law and Social Change*, 81(3), 255–280. <https://doi.org/10.1007/s10611-023-10116-8>
- Ferencek, A., Kljajić, M., & Borštnar, K. (2025). Open Government Data Topic Modeling and Taxonomy Development. *Systems*, 13(4), 242. <https://doi.org/10.3390/systems13040242>
- Fuentes Henriques, R., Morais, A., Wu, D., & Memon, H. (2022). Public Pressure, Environmental Policy Uncertainty, and Enterprises' Environmental Information Disclosure. *Sustainability*, 14(12), 6948. <https://doi.org/10.3390/su14126948>
- Gutierrez-Bustamante, M., & Espinosa-Leal, L. (2022). Natural Language Processing Methods for Scoring Sustainability Reports—A Study of Nordic Listed Companies. *Sustainability*, 14(15), 9165. <https://doi.org/10.3390/su14159165>
- Haleem, F., Farooq, S., Cheng, Y., & Waehrens, B. V. (2022). Sustainable Management Practices and Stakeholder Pressure: A Systematic Literature Review. *Sustainability*, 14(4), 1–23. <https://doi.org/10.3390/su14041967>
- Hamilton, S. N., & Waters, R. D. (2022). Mainstreaming Standardized Sustainability Reporting: Comparing Fortune 50 Corporations' and U.S. News & World Report's Top 50 Global Universities' Sustainability Reports. *Sustainability*, 14(6), 3442. <https://doi.org/10.3390/su14063442>
- Hsueh, J. W. J., De Massis, A., & Gomez-Mejia, L. (2023). Examining Heterogeneous Configurations of Socioemotional Wealth in Family Firms Through the Formalization of Corporate Social Responsibility Strategy. *Family Business Review*, 36(2), 172–198. <https://doi.org/10.1177/08944865221146350>
- Kumar Nallapaneni, M., Adamo, I. D. ', Gastaldi, M., Sassanelli, C., Santibanez Gonzalez, E. D. R., Kandpal, V., Machado, M., Martens, M. L., & Majumdar, S. (2023). A Bibliometric Analysis of Circular Economies through Sustainable Smart Cities. *Sustainability*, 15(22), 15892. <https://doi.org/10.3390/su152215892>
- Mariani, L., Trivellato, B., Martini, M., & Marafioti, E. (2022). Achieving Sustainable Development Goals Through Collaborative Innovation: Evidence from Four European Initiatives. *Journal of Business Ethics*, 180(4), 1075–1095. <https://doi.org/10.1007/s10551-022-05193-z>
- Martiny, A., Taglialatela, J., Testa, F., & Iraldo, F. (2024). Determinants of Environmental Social and Governance (ESG) Performance: A Systematic Literature Review. *Journal of Cleaner Production*, 456, 142213. <https://doi.org/10.1016/j.jclepro.2024.142213>
- Nazir, S., Zhaolei, L., Mehmood, S., & Nazir, Z. (2024). Impact of Green Supply Chain Management Practices on the Environmental Performance of Manufacturing Firms Considering Institutional Pressure as a Moderator. *Sustainability*, 16(6), 2278. <https://doi.org/10.3390/su16062278>
- Poiriazzi, E., Zournatzidou, G., Konteos, G., & Sariannidis, N. (2025). Analyzing the Interconnection Between Environmental, Social, and Governance (ESG) Criteria and Corporate Corruption: Revealing the Significant Impact of Greenwashing. *Administrative Sciences*, 15(3), 100. <https://doi.org/10.3390/admsci15030100>

- Pranugrahaning, A., Donovan, J. D., Topple, C., & Masli, E. K. (2023). Exploring Corporate Sustainability in the Insurance Sector: A Case Study of a Multinational Enterprise Engaging with UN SDGs in Malaysia. *Sustainability*, 15(11), 8609. <https://doi.org/10.3390/su15118609>
- Raman, R., Sreenivasan, A., Ma, S., Patwardhan, A., & Nedungadi, P. (2023). Green Supply Chain Management Research Trends and Linkages to UN Sustainable Development Goals. *Sustainability*, 15(22), 15848. <https://doi.org/10.3390/su152215848>
- Santoso, R. W., Siagian, H., Tarigan, Z. J. H., & Jie, F. (2022). Assessing the Benefit of Adopting ERP Technology and Practicing Green Supply Chain Management toward Operational Performance: An Evidence from Indonesia. *Sustainability*, 14(9), 1–21. <https://doi.org/10.3390/su14094944>
- Sherif, Z., Sarfraz, S., Jolly, M., & Saloniitis, K. (2022). Identification of the Right Environmental KPIs for Manufacturing Operations: Towards a Continuous Sustainability Framework. *Materials*, 15(21), 7690. <https://doi.org/10.3390/ma15217690>
- Suta, A., Molnár, P., Limbach, Z., & Tóth, Á. (2025). Dictionary-Based Assessment of European Sustainability Reporting Standard (ESRS) Disclosure Topics. *Discover Sustainability*, 6(1), 146. <https://doi.org/10.1007/s43621-025-00930-6>
- Ursino, D., Seng, K. P., Berceanu, D., Ionescu, S.-A., Diaconita, V., & Radu, A.-O. (2025). Engineering Sustainable Data Architectures for Modern Financial Institutions. *Electronics*, 14(8), 1650. <https://doi.org/10.3390/electronics14081650>
- Villacampa-Porta, J., Coronado-Vaca, M., & Garrido-Merchán, E. C. (2025). Impact of EU non-financial reporting regulation on Spanish companies' environmental disclosure: a cutting-edge natural language processing approach. In *Environmental Sciences Europe* (Vol. 37, Issue 1). Springer Berlin Heidelberg. <https://doi.org/10.1186/s12302-025-01067-z>
- Wiegand, T., & Wynn, M. (2023). Sustainability, the Circular Economy and Digitalisation in the German Textile and Clothing Industry. *Sustainability*, 15(11), 9111. <https://doi.org/10.3390/su15119111>
- Zatonatska, T., Soboliev, O., Zatonatskiy, D., Dluhopolska, T., Rutkowski, M., & Rak, N. (2024). A Comprehensive Analysis of the Best Practices in Applying Environmental, Social, and Governance Criteria within the Energy Sector. *Energies*, 17(12), 2950. <https://doi.org/10.3390/en17122950>
- Zervoudi, E. K., Moschos, N., & Christopoulos, A. G. (2025). From the Corporate Social Responsibility (CSR) and the Environmental, Social and Governance (ESG) Criteria to the Greenwashing Phenomenon: A Comprehensive Literature Review About the Causes, Consequences and Solutions of the Phenomenon with Specific Case. *Sustainability*, 17(5), 2222. <https://doi.org/10.3390/su17052222>