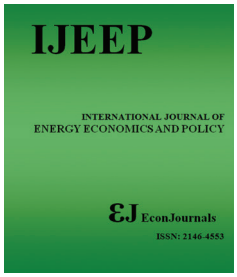

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Corporate Strategy for Quality GHG Emissions Disclosure: A Systematic Review

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ABSTRACT

This systematic review analyses the factors that influence the quality of corporate GHG emissions disclosure and strategies for improvement. The research methodology includes English-language scientific articles (2014-2025) from the Scopus and Web of Science databases that explicitly discuss GHG emissions disclosure. From 128 studies that passed the Cohen's Kappa reliability test, thematic analysis using NVivo 15 identified four main categories: Drivers, barriers, enablers, and outcomes of disclosure. The findings show that external factors such as regulations and stakeholder pressure are the main drivers of disclosure. However, the absence of uniform regulations and limitations in companies' internal capacity to manage emissions data remain major challenges. The analysis recognized adopting innovative technologies, external audits, and enhancing corporate governance. Integrating these universally improves corporate reputation, finances, and value, and decreases the cost of capital. Determining the needs of companies in developing transparent and credible reports on emissions. This study proposes a GHG disclosure strategy matrix as a practical guide for companies in formulating more transparent and credible emissions reports. The resulting matrix is expected to serve as a strategic instrument for improving the accuracy and transparency of corporate emissions reporting.

Keywords: GHG Disclosure, Emissions Reporting, Strategies, Transparency, Systematic Literature Review
JEL Classifications: L25, M41, Q54, Q56

1. INTRODUCTION

Growing global concerns about climate change have prompted companies to integrate environmental and sustainability goals into their business strategies, driven by public pressure and consumer preferences for environmentally friendly products (Atia et al., 2020; Christ and Burritt, 2013; Latan et al., 2018; Zhang et al., 2020). Disclosure of greenhouse gas (GHG) emissions is crucial for various stakeholders, including managers who oversee corporate strategy, policymakers who design environmental regulations, investors who assess climate risk, and the public who demand environmental accountability. Data shows that the world's 100 largest companies are responsible for 71% of emissions since 1988 (Valayden and Chabaud, 2024). This urgency confirms that GHG emissions disclosure is not only a corporate responsibility but also a strategic necessity to maintain legitimacy and meet stakeholder expectations.

Research has shown that GHG emissions disclosure is influenced by various complementary theoretical perspectives. Legitimacy theory explains that companies use emissions disclosure to maintain social contracts with the public, often through "greenwashing" practices to change public perception, especially by companies with poor environmental performance (Khan and Khan, 2025; Solikhah et al., 2020). Stakeholder theory asserts that emissions disclosure is a strategic response to pressure from stakeholders concerned about climate issues, aiming to reduce information asymmetry (Freeman, 1984; Liao et al., 2015). Agency theory suggests that carbon disclosure increases transparency to reduce conflicts of interest between principals and agents (Healy

and Palepu, 2001; Jensen and Meckling, 1976). Institutional theory reveals that disclosure practices are shaped by institutional pressures through coercive, normative, and mimetic isomorphism mechanisms (DiMaggio and Powell, 1983; Meyer and Rowan, 1977). Empirical studies also show a positive relationship between GHG reporting quality and financial performance in developing countries (Nichita et al., 2021).

Nevertheless, there are still significant gaps in the literature. Previous studies tend to focus on partial aspects, such as the influence of regulation (He et al., 2023; Tomar, 2023), company characteristics (Abdullah et al., 2020; Rahmawati et al., 2024), or corporate governance (Abd Majid and Jaaffar, 2023; Abdalla et al., 2024b), without integrating these factors into a holistic framework. These studies emphasise reporting outcomes or data accuracy rather than internal mechanisms or transformational strategies to improve disclosure quality (Döring et al., 2023; Nichita et al., 2021). Furthermore, the lack of large-scale empirical research on the driving factors in emissions disclosure remains an obstacle (Luo et al., 2021). The absence of systematic review of practical strategies that companies can implement to improve disclosure quality further highlights this gap.

This is important because there is a paradox in GHG emissions disclosure practices: Regulatory and stakeholder pressure encourage transparency (Chithambo et al., 2020; Shao and He, 2022), but institutional, economic, and technical barriers hinder the implementation of quality disclosure (Abdalla et al., 2024a; Cai et al., 2024; Ma et al., 2024). The phenomenon of greenwashing, where companies use symbolic disclosure to alleviate legitimacy pressure without substantial change, complicates efforts towards true transparency (Khan and Khan, 2025; Mateo-Márquez et al., 2022). Addressing this gap is important to support long-term sustainable development, reduce greenwashing practices, and enhance corporate accountability in the face of global climate change challenges.

This study aims to identify factors that influence the quality of GHG emissions disclosure through a systematic literature review, focusing on practical strategies that companies can adopt to improve reporting transparency. Theoretically, this study enriches the literature by developing a GHG disclosure strategy matrix that integrates external pressures (such as regulations and stakeholders) and internal capabilities (such as technology and governance) to guide companies towards more effective disclosure. It also builds insights into disclosure motives, such as social legitimacy and regulatory pressure, and improves reporting quality through the use of advanced technology. Furthermore, it affirms the role of organisations as active agents of change in sustainability accounting, particularly in major emitting countries, highlighting the transition from symbolic to substantive disclosure, even if initially driven by legitimacy concerns due to regulatory pressure. Practically, this research offers guidance for managers to overcome disclosure challenges, such as data and resource limitations, supports policymakers in designing a uniform regulatory framework, and benefits stakeholders by explaining the advantages of emissions disclosure, such as reduced capital costs and enhanced reputation.

To achieve these objectives, this study is guided by the following research questions, which are systematically designed to explore the evolution, influencing factors, and optimal strategies in GHG emissions disclosure:

RQ 1: How has research on greenhouse gas emissions disclosure evolved in the literature?

RQ 2: What are the drivers, barriers, enablers, and outcomes of GHG emissions disclosure?

RQ 3: What strategies can companies adopt to optimise GHG emissions disclosure?

2. RESEARCH METHOD

2.1. Identification Process

This study uses SLR, which is useful for answering specific questions and exploring methodologies in developing fields of literature (Manetti et al., 2021; Kaur et al., 2023), including GHG emissions disclosure. This review uses the PRISMA method described by Xiao and Watson (2019) to improve the clarity, organisation, and reproducibility of the work, while reducing duplicative effort and bias (Fink, 2005; Meijer and Bolívar, 2016; Parmentola et al., 2022; Swalih et al., 2024). This review, a thematic analysis, serves to highlight aspects, concepts, theories, practices, and recent advances in GHG emissions disclosure (Shoeb et al., 2022). The identification process was based on two leading electronic databases, Scopus and Web of Science, to ensure the validity and relevance of the literature identified in this study. The search strategy applied used a combination of specific keywords, such as ("corporate" OR "business" OR "enterprise") AND ("GHG" OR "Carbon") AND ("disclosure" OR "reporting") AND ("standards" OR "guidelines" OR "frameworks" OR "regulations" OR "challenges" OR "issues" OR "problem" OR "strategies"). These keywords were carefully selected to capture all relevant literature while maintaining the specificity of the research topic.

2.2. Inclusion and Exclusion Criteria

The literature identification process was limited to publications published between 2014 and 2025 to ensure the inclusion of the latest literature on GHG emissions disclosure. Inclusion criteria included English-language scientific articles that were openly available and explicitly discussed GHG emissions disclosure by companies. Exclusion criteria included: Publications before 2014; non-English articles; review articles; conference proceedings and papers; books and book chapters; other publications such as editorial notes, erratum, data papers, brief surveys, and retracted articles. This literature review did not include grey literature, including institutional repositories and sources from Google Scholar, due to methodological limitations, such as lack of peer review, volatility of sources, lack of methodological transparency, and less in-depth coverage (Elston et al., 2025; Grybauskas et al., 2022; Yasin et al., 2020).

2.3. Data Selection

The article selection process was conducted systematically using the Parsif.al platform to screen articles based on inclusion and exclusion criteria, followed by manual validation using Excel for in-depth analysis. This approach ensured the accuracy of

article selection while maintaining transparency and consistency throughout the review process (Felix and Martins, 2024).

2.4. Risk of Bias Assessment

Two independent researchers conducted double review to control and reduce bias in the study (Naicker et al., 2025). Only studies that met strict criteria were included in the final analysis. In addition, the reporting of results refers to the PRISMA guidelines to ensure transparency and replicability of the review process (Shamseer et al., 2015).

2.5. Study Quality Assessment

The process of assessing the quality of studies in this review aims to improve the reliability of studies and provide a clearer understanding of the evidence related to the topic under investigation (Naicker et al., 2025; Shamseer et al., 2015). Quality assessment was conducted using the Kappa reliability test and Inter-Rater Reliability (IRR) using NVivo 15, where the Kappa test was used for exclusive coding categories, while IRR was used for information that could be coded into several categories (Campbell et al., 2013; Eccleston et al., 2001). The coding results were then compared and discussed to resolve any differences that arose and to reach consensus on the definition and application of codes (Naicker et al., 2025). The level of agreement used refers to the criteria of Fleiss et al. (2003), which classify the interpretation of Kappa values into three main categories (Table 1).

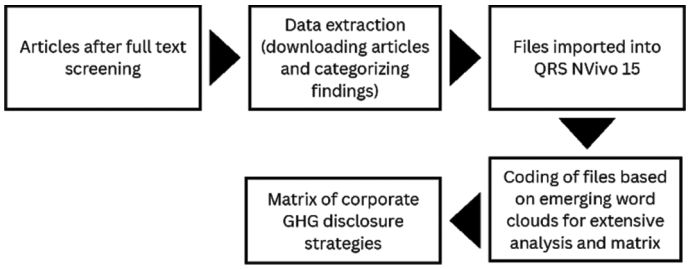
2.6. Data Analysis (Thematic)

This review uses thematic analysis developed based on previous research (Asif et al., 2023; Swalih et al., 2024) and was largely developed *ad hoc* to enrich the understanding of corporate strategies to improve the quality of GHG emissions disclosure. Figure 1 shows the coding process in this study. The final result of this iterative process is the formation of a comprehensive corporate GHG disclosure strategy matrix, which describes the various approaches and patterns of GHG emissions disclosure applied by companies in the context of their environmental responsibility.

Table 1: Interpretation of agreement

Kappa values	Interpretation
<0.40	Poor agreement
0.40-0.75	Fair to good agreement
>0.75	Excellent agreement

Figure 1: Coding theme synthesis



Source: Author's elaboration

3. RESULTS

Figure 2 shows the systematic process of selecting studies for this literature review. The process began with an identification stage that successfully collected a total of 1,904 records from two data sources, namely Scopus (n = 1,207) and WoS (n = 697). Of these, 975 articles were eliminated, 411 duplicate records were removed, and the selection continued based on predetermined inclusion and exclusion criteria, such as publication year before 2014 (213), non-English language (47), irrelevant article types such as reviews (74), proceedings (64), conferences (71), books and book chapters (86), and blank records or entries (9), leaving 929 records that passed to the next stage, namely screening based on title and abstract, which left 168 reports to be searched for and retrieved, but 40 reports could not be obtained. Subsequently, the 128 available reports were assessed for eligibility and all met the criteria, thus being included in the final synthesis of the review.

3.1. Reliability and Quality Test Study

The reliability test results for 128 studies using Cohen''s Kappa from NVivo 15 showed high consistency between the two researchers when conducting assessments. The findings indicate that all studies show high inter-rater agreement, with percentages averaging above 98%, demonstrating reliable methodological validity. Substantively, the research contributions show an uneven but complementary pattern. Although some studies contributed minimally to one or more categories, the studies collectively enriched the understanding of the interactions between Drivers, Barriers, Strategies, and Outcomes in this study. The Inter-Rater Reliability (IRR) values and details of the research contributions are provided in the Appendix

3.2. Research Trends Related to GHG Disclosure

Figure 3 shows that GHG disclosure has increased significantly in recent years, with a sharp surge in 2023 and peaking in 2024-2025. This increase indicates a growing trend in the adoption of corporate strategies to improve transparency and accuracy in GHG emissions disclosure, which over time has been increasingly influenced by external factors such as stricter regulations, stakeholder demands, and market pressure to implement better environmental practices. This analysis provides important insights into the dynamics of GHG emissions disclosure and highlights the steps companies are taking to respond to this growing demand. The observed growth pattern shows that companies are increasingly recognising the importance of transparency in emissions reporting as part of their sustainability strategies.

Figure 4 shows a dramatic increase in the number and diversity of theories used, peaking in 2019-2020. Legitimacy Theory, as a classical theory, remains relevant and dominant, as the issues of climate change and GHG emissions are closely related to the social legitimacy of companies in the public eye, especially in an era of increasing environmental awareness. This indicates that researchers consistently view GHG emissions disclosure as an effort by companies to legitimise their operations in the eyes of the public. Interestingly, theoretical diversification has strengthened over time. The adoption of stakeholder theory, institutional theory,

Figure 2: Prisma diagram flow

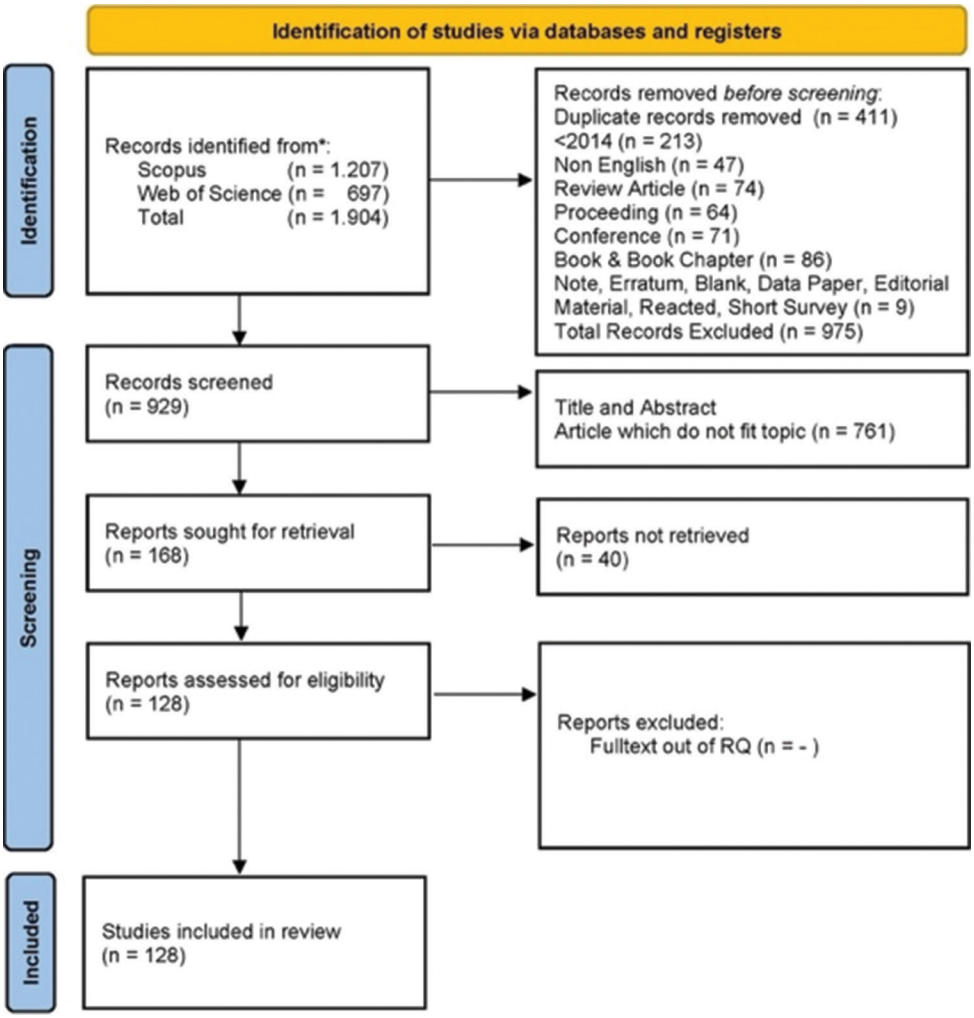
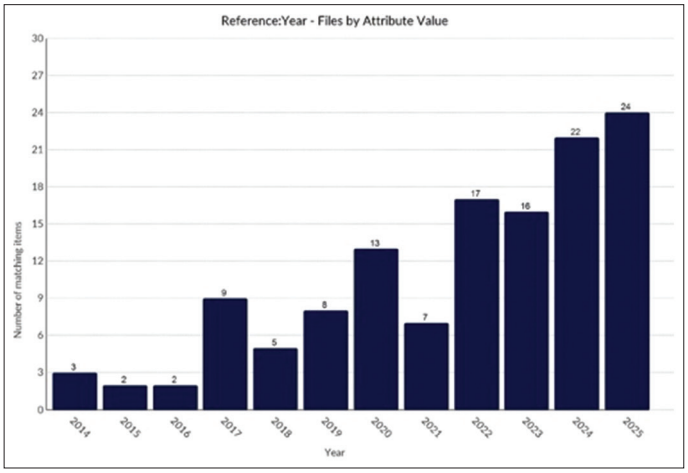
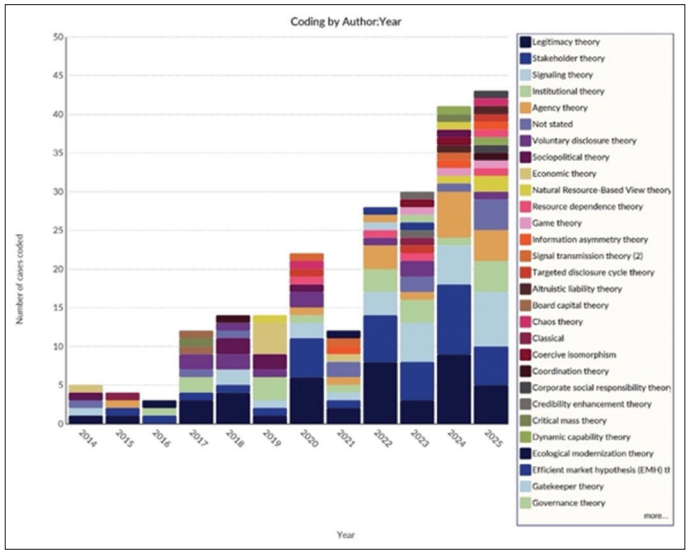


Figure 3: Distribution trend



Source: Author elaborated using NVivo 15

Figure 4: Theoretical in GHG disclosure



Source: Author elaborated using NVivo 15

and various other theories such as Signalling Theory and agency theory indicates that the phenomenon of GHG emissions disclosure is increasingly understood as a multidimensional issue that requires a more comprehensive and integrated theoretical approach, no longer viewed from a single theoretical perspective. This reflects the growing understanding that GHG emissions disclosure is not just a matter of technical compliance, but a multidimensional phenomenon influenced by the dynamics of social legitimacy, institutional pressure, communication strategies, and the need to respond to global sustainability challenges.

In Figure 5, a word cloud illustrates the core themes associated with GHG disclosures and corporate sustainability. The prominence of the terms "carbon" and "disclosure" highlights the critical need for reporting transparency, which remains a central concern in sustainability disclosures. In addition, the terms "information," "management," and "performance" signify that GHG disclosure goes beyond mere emissions measurement and encompasses the management and reporting of emissions as a component of corporate performance with respect to sustainability. The terms "voluntary," "strategy," and "sustainability" allude to the fact that, although the disclosure of GHG emissions is voluntary, there is a significant strategic focus on long-term corporate sustainability, which is the primary goal of emerging legislation. Such GHG disclosure demonstrates the influence of external stakeholders, including governments and investors, on a firm's reporting practices and the strategic GHG policies that a firm adopts. GHG disclosure, in turn, influences corporate standing and competitiveness in the world market.

3.3. Key Factors Affecting GHG Disclosure

The disclosure of GHG emissions is influenced by various complex and interrelated factors. The drivers–barriers–enablers–outcomes framework is used to identify and analyse key themes covering factors relating to how and why companies disclose GHG emissions. This analysis is based on a comprehensive theoretical foundation to provide an in-depth understanding of the dynamics of emissions disclosure.

3.3.1. Drivers of GHG emissions disclosure

Table 2 presents a synthesis of factors driving GHG emissions disclosure based on relevant themes, sub-themes, topics, and sources.

Regulatory pressure has emerged as the main external catalyst driving fundamental transformation in corporate GHG emissions disclosure practices. The implementation of environmental information disclosure policies in various countries has demonstrated significant effectiveness in reducing pollutant and carbon emissions, including SO_2 and GHG, especially after the implementation of mandatory regulations (He et al., 2023; Ren et al., 2024; Shi et al., 2021; Tomar, 2023). In China, for example, regulatory pressure has encouraged companies to meet government standards to avoid sanctions, although the response of companies still tends to be reactive rather than proactive (Cai et al., 2024; Liu et al., 2025a; Liu and Anbumozhi, 2009; Zhu et al., 2024). This phenomenon is reinforced by environmental sanction mechanisms that have been shown to increase disclosure tendencies, particularly among resource-rich companies, while social media monitoring further strengthens public pressure for information disclosure (Cai et al., 2024; Shao et al., 2025). Additionally, compliance with regulations like carbon reporting in the UK and United States enhances disclosure quality and minimizes greenwashing by fostering transparency and mitigating overstatements (Downar et al., 2021; Grewal et al., 2024). Indeed, UK firms with mandates have been reported to decrease GHG emissions by about 8% in contrast to a European control group that does not have mandates (Downar et al., 2021; Sneideriene and Legenzova, 2025).

Alongside regulatory pressure, market dynamics brought about by investors and shareholders have created another layer of pressure that is equally important. Institutional investors and shareholders actively advocate for adherence to global standards for climate-related financial disclosures and the consideration of climate-related risks in their investment portfolios (Akbaş and Canikli, 2019; Florackis et al., 2025). This change in expectations has spurred numerous corporations to revise their carbon-related policies as corporate carbon transparency is increasingly recognized as a strategic asset for corporate reputation and market positioning (Mateo-Márquez et al., 2021). Beyond the formal

Figure 5: Emerging word clouds

Source: Author elaborated using NVivo 15

Table 2: Drivers of GHG emissions disclosure

Theme	Sub-theme	Component
External drivers	Pressure	Regulatory pressures
		Investors and shareholders pressure
		Public/social pressure
		Media pressure
		Customer pressure
Internal drivers	Legitimacy	Legitimacy seeking
	Firm characteristics	Firm size
		Financial performance
		Green investments
	Corporate governance	Board independence
		Leadership structure
		Board effectiveness
		Ownership structure
		Sustainability committee
		Board structure
	Financing and support access	Sustainable financing
		Optimization of financing terms
		Institutional financing
	Organizational culture	Leadership style
		Values and norms
		Communication
		Adaptability cooperation

Source: Author's elaboration

expectations of the capital markets, uncovered social aspects amplify the pressure cross-politically by means of the media and civil society. Such expectations feel like social regulation and are amplified by civil and formal regulation (Guenther et al., 2016; Jiang et al., 2022; Kılıç and Kuzey, 2019; Saha and Maji, 2025). Market expectations, which cannot be ignored, emanate from civil society stakeholders concerned with accountability and transparency for corporate emissions disclosure (Jiang et al., 2022; Kılıç and Kuzey, 2019).

The search for legitimacy internally acts as a conceptual "bridge" connecting external pressures with organisational responses. Companies disclose GHG emissions as a means of sustaining the social contract with the society, maintaining trust, and ensuring the continuity of their operational activities within environmentally conscious operational surroundings (Luo et al., 2022; Tang et al., 2020). The search for legitimacy and the disclosure of GHG emissions is influenced, albeit to varying degrees, by firm specific characteristics, with firm size being one of the most significant. Larger firms tend to possess adequate resources and face more intense stakeholder scrutiny, thus adopting opacity as a risk mitigation strategy (Abdullah et al., 2020; Bedi and Singh, 2024b; Rahmawati et al., 2024). The role of company specific characteristics strongly suggests that while external pressures may provide the initial trigger, it is ultimately the internal disposable capacity of the firm—and the associated financial resources, technology, and know-how—that determines the quantity and quality of GHG emissions disclosure.

In addition, a strong governance structure, characterised by a high degree of board independence, the existence of sustainability committees, and board diversity, has been shown to improve the credibility and substance of emissions reporting (Abdalla et al., 2024a; Abdul Majid et al., 2023; Al-Qahtani and Elgharbawy, 2020; Barg et al., 2024; Chithambo et al., 2020; Ratmono et al., 2022). Research shows that the presence of female directors correlates positively with more substantial disclosure, especially in companies with low leverage, indicating that diversity of perspectives on the board of directors allows for more inclusive decision-making, which in turn encourages more substantial reporting practices (Abdalla et al., 2024a).

Support for and access to financing are also increasingly important internal drivers. Access to financing is important because it helps to improve a company's standing and reputational value within a competitive marketplace. Equally, a well thought out and implemented carbon financing strategy positively positions a company to access more sustainable and cheaper financing options, including green bonds and green loans, which are crucial for attracting green investors and lowering debt financing costs (Ardianto et al. 2023; Liu et al. 2025b; Ma, 2025). Additionally, organisational culture shapes the basic approach to environmental transparency, which considers the values, norms, and leadership styles within an organisation. For example, organisations with an adaptive culture, especially those shaped by Confucian values in China, show a consistent approach in offering environmental transparency and providing relevant information to stakeholders, which supports accurate and consistent disclosure (Frisch, 2024; Tang et al., 2022; Tian et al., 2024). An adaptive and strong organisational culture augments the integration of outside pressures with internal capabilities and rapidly advances the company's ability to construct proactive disclosure frameworks. Hence, the disclosure of GHG emissions is proactive and portends positively to the company because it reflects a strong internal strategy, upholding company value and reinforcing sustainability through accountability, innovation, operational efficiency, and improved reputation (Döring et al., 2023; Hassan and Romilly, 2018).

3.3.2. Barriers of GHG emissions disclosure

The limitations of GHG emissions disclosure come from four different yet interconnected perspectives: institutional, economic, strategic, and technical. Table 3 summarizes the barriers. As an example, institutional challenges may include underdeveloped and unregulated frameworks, as well as underdeveloped and unregulated challenges. Abdalla et al. (2024a) and Cai et al. (2024) pointed out that the absence of generic standards results in discrepancies in emissions reporting, as disclosure practices vary widely between companies, making it almost impossible to evaluate emissions data (Zhang and Liu, 2020). The voluntary nature of disclosure, as identified by Abdalla et al. (2024b) and Huang et al. (2025), exacerbates this problem because companies have no legal obligation to report comprehensively, resulting in low motivation to participate in GHG disclosure (Kim and Lyon, 2011). Furthermore, the lack of external verification and effective oversight, as noted by Jiang et al. (2024), allows companies to provide inaccurate or manipulative information, which often cannot be detected by external stakeholders (Luo et al., 2022).

Economic barriers pose the next challenge in GHG emissions reporting, particularly in relation to financial burdens and resource constraints. The costs of disclosure and reporting, including the creation of emissions inventories and the development of carbon

Table 3: Barriers of GHG emissions disclosure

Theme	Sub-theme	Component
Institutional barriers	Regulation and standardisation	Lack of uniform standards Weak regulatory system Voluntary nature of disclosure
	Verification and monitoring	Lack of external verification Supervision not yet effective
Economic barriers	Financial Burden	Disclosure and reporting costs System and infrastructure costs
	Resource constraints	Financial constraintsHuman resource constraints
Strategic barriers	Reputation management	Greenwashing Information manipulationSymbolic disclosure
	Competitive risk	Loss of competitive advantage Litigation risk
	Motivation and incentives	Lack of internal motivation Focus on reputation vs substance
Technical barriers	Data quality	Poor comparability Inconsistency of information Complexity of emissions data
	Organisational capacity	Lack of technical expertise Limitations of information systems Administrative burden

Source: Author's elaboration

accounting systems, are considered high, especially for small companies or those with poor environmental performance (Datt et al., 2019; Luo and Tang, 2014). Ma et al. (2024) highlight that small companies face greater challenges in collecting emissions data due to financial and human resource constraints, a finding reinforced by Hsueh (2019), who states that resource constraints in developing countries hinder commitment to carbon mitigation. Furthermore, investment in emission reduction projects requires large funds, which can burden company operations, especially those with financial limitations, thereby reducing enthusiasm for disclosure (Tang et al., 2022).

Besides institutional and economic constraints, strategic challenges that impact GHG emissions disclosure entail different sets of issues. Greenwashing and information manipulation, where firms put forth a favorable impression while doing little to abate emissions, is quite pervasive (Mateo-Márquez et al., 2022; Sun et al., 2025). Luo et al. (2022) described the emissions GHG disclosure spiral where firms under pressure to provide legitimacy for their emissions relax disclosures in the symbolic range. Their motivation seems to remain focused in reputation rather than the environmental performance (Momin et al., 2017). The challenges of losing a competitive edge and possible harmful litigation described by Luo and Tang (2014) remain dominant and explain why firms are reluctant to disclose certain information. Competitors could use the information while litigation from environmental activists is well documented (Li et al., 1997). The situation is further complicated by the lack of motivation internally described by Huang et al. (2025) and Xu et al. (2025). For many firms, emissions disclosure seems disconnected to benefits unless there are strong market incentives (Tauringana and Chithambo, 2015).

Technical barriers worsen the challenges posed by poor data quality and data organisational capacity. According to Abdalla et al. (2024a) and Frisch (2024), in the absence of uniform reporting standards, the variability of disclosure practices across firms results in poor data comparability and inconsistent information (Kolk et al., 2008). The intricacies of emissions data—particularly Scope 3 emissions—and challenges posed by inconsistent reporting standards and the elusive nature of supply chain emissions further complicate the issue (Chen et al., 2025; Hettler and Graf-Vlachy, 2024). Data inaccuracies, as Ma et al. (2024) points out, are also due to the limitations of a company's information system and the absence of technical know-how. Imposed administrative burdens, as Frisch (2024) points out, are particularly challenging for resource-constrained firms in the emission data complexities during the low administrative burdens.

This shows that these barriers are interrelated and reinforce each other. The lack of regulation and standards creates an environment in which companies can avoid disclosure or present inaccurate information without significant consequences. Economic and technical barriers, such as high costs and lack of expertise, exacerbate companies' low internal motivation to report transparently. Meanwhile, greenwashing practices show that many companies prioritise short-term reputation over long-term commitment to sustainability. These findings underscore that the lack of a strong regulatory framework and uniform reporting standards is at the root of many problems, which are then exacerbated by resource constraints and strategic motivations.

From a theoretical perspective, this barrier could be understood from multiple angles. Legitimacy theory posits that firms engage in carbon disclosure as a form of impression management to maintain social legitimacy, despite not making any meaningful changes to their practices (Liu et al., 2023; Mateo-Márquez et al., 2022). Ownership cost theory offers an explanation as to why firms opt not to disclose everything, in this case, to manage their risk of losing a competitive edge or being sued (Luo and Tang, 2014). Agency theory studies the conflict of interests between the managers of a corporation and the external stakeholders, where managers may disguise poor environmental performance by "under the table" practices (Datt et al., 2019). The resource-based view addresses the need to acknowledge the financial and technical barriers that prevent firms from implementing effective reporting systems (Hsueh, 2019). The combination of these theories suggests the necessity of adopting a more comprehensive view that combines the imposition of more stringent rules, financial incentives, and enhanced technical capabilities in order to facilitate the open and substantive disclosure of greenhouse gas emissions.

3.4. Enablers of GHG Emissions Disclosure

In addition to the driving factors that influence GHG emissions disclosure, there are enabler factors that, although not involved in initial adoption, are important for improving transparency and disclosure quality. These factors, such as external audits, technology, governance strengthening, standards, and reward and penalty systems, work synergistically to support more effective disclosure. A synthesis of these factors is presented in Table 4.

External audits and verifications serve as independent mechanisms to validate the GHG emissions data disclosed by companies, ensuring the accuracy and credibility of the information. This process involves third parties, such as large audit firms (Big Four) or carbon verification agencies, which evaluate emissions data based on internationally recognised standards. According to Jiang et al. (2024) and Luo et al. (2023), third-party verification increases stakeholder confidence by reducing the risk of data manipulation and providing assurance of the reliability of the information disclosed. Specifically, big audit firms contribute to enhancing reporting quality because their reputation is associated with high professional standards, which can reduce firms' financing costs through increased perceived value in the market (Luo, 2014). In addition, carbon assurance serves as a managerial monitoring tool, ensuring management's compliance with the company's environmental commitments, as highlighted by Velte (2025). This process enhances the usefulness of emissions information for decision-makers, such as investors and regulators, by providing independently verified data. Siddique et al. (2024) asserts that external verification is considered a prequalification of data, thereby increasing the value of information for strategic decision-making. External audits and verification are also aligned with global standards and guidelines, such as GRI or CDP, ensuring compliance with international reporting frameworks. This provides a reliable basis for evaluating a company's compliance with

Table 4: Enablers of GHG emissions disclosure

Theme	Description	Key points
External audit and verification	Independent inspection mechanisms to verify and validate GHG emissions information disclosed by companies	Third-party verification enhances credibility and stakeholder trust Big 4 auditors are associated with higher reporting quality Carbon assurance serves as a monitoring tool for management External verification improves the usefulness of information for decision-making
Technology and innovation	Utilisation of digital technology and green innovation to improve carbon information disclosure and management	Blockchain improves supply chain coordination for Scope 3 emissions data AI and machine learning automate carbon data collection Green innovation strengthens the financial benefits of carbon disclosure Cloud computing facilitates collaborative emission reduction initiatives Advanced monitoring technology improves emission data accuracy
Governance strengthening	Corporate governance structures and mechanisms that support quality carbon information disclosure	Environmental committees demonstrate corporate commitment to climate change Gender diversity on boards of directors improves disclosure quality Chief sustainability officers (CSOs) are positively associated with GHG disclosure Risk committees help anticipate the financial impact of carbon regulations Committed leadership creates a culture of openness
Standards and guidelines	Frameworks, guidelines, and standards governing carbon information disclosure	Adoption of GRI Guidelines improves the quality and scope of reporting The CDP framework provides a comprehensive reporting structure Standardisation can improve the reliability of information International standards provide methodological guidance
Rewards and penalty	Incentive and penalty systems to encourage quality carbon information disclosure	Tax incentives encourage participation in carbon reporting programmes Environmental sanctions are effective as drivers of disclosure Executive compensation linked to carbon targets increases transparency Government subsidies and green loans for companies with good disclosure A combination of rewards and penalty is more effective than a single policy Companies with good carbon performance have incentives to differentiate themselves

Source: Author's elaboration

regulations or eligibility for incentives, such as tax reductions for validated reporting.

From an agency theory perspective, external audits and verifications reduce information asymmetry between management and stakeholders by ensuring that GHG emissions data is free from manipulation for managerial interests. Based on signalling theory, companies that engage reputable auditors or third-party verifiers send a strong signal about their commitment to transparency, distinguishing themselves from companies with poorer environmental performance. This interaction strengthens the legitimacy of companies in the eyes of stakeholders, supporting more responsible governance. Therefore, external audits and verification have been proven effective in improving the credibility, transparency, and environmental performance of companies, as well as strengthening stakeholder confidence in GHG emissions disclosure (Fan et al., 2020; Gu et al., 2023).

Technology and innovation have brought about significant changes in the collection, management, and reporting of GHG emissions data with higher levels of accuracy and efficiency. Blockchain, as explained by Chen et al (2025), improves coordination in the supply chain for Scope 3 emissions data, which is often complex because it involves many parties. AI and machine learning automate the collection and analysis of emissions data, reducing human error, identifying disclosure patterns, and improving data prediction and classification for more credible reporting (Bajic, 2023; Liu et al., 2025b). Green innovation, according to He et al. (2023) and Li et al. (2018), enables companies to develop environmentally friendly technologies and practices, which not only reduce emissions but also strengthen the company's environmental image. IoT enables real-time data collection, speeds up the emissions accounting process, and allows for the direct identification of areas for emissions reduction (Hylleseth et al., 2024). Cloud computing supports collaboration between parties in the supply chain for emission reduction initiatives (Yulianti and Waworuntu, 2025). Even China has utilised satellite imagery through the TanSat mission, a GHG monitoring satellite, to improve the accuracy of emission monitoring (Boesch et al., 2021). These technologies improve the accuracy, transparency, and credibility of emissions disclosure, enabling companies to provide more comprehensive and reliable data. Yulianti and Waworuntu (2025) assert that advanced monitoring technologies enable more accurate emissions reporting, thereby supporting stakeholder trust.

Strengthening corporate governance involves organisational structures such as environmental committees, independent and diverse boards of directors, and the presence of a Chief Sustainability Officer (CSO), which encourages commitment to sustainability and improves the quality of GHG emissions disclosure. Bedi and Singh (2024a) and Budianto et al. (2025) emphasise that environmental committees reflect a company's dedication to addressing climate change and guide management in meeting stakeholder expectations. Cross-country and cross-sector (Kılıç and Kuzey, 2019; Peters and Romi, 2014) show that environmental committees and CSOs play an important role in improving the transparency and completeness of GHG emissions reporting, both voluntary and mandatory. CSOs also play a role in integrating sustainability issues into companies' long-term strategies (Dhanda and Malik, 2020). Meanwhile, audit committees tangibly increase the likelihood and quality of GHG emissions disclosure by ensuring data accuracy and compliance (Kılıç and Kuzey, 2019). Gender diversity and the background of board members can improve the quality of disclosure by bringing a more inclusive perspective to decision-making, which in turn encourages broader and more credible emissions reporting (Abd

Majid and Jaaffar, 2023; Hollindale et al., 2017; Liao et al., 2015). Risk committees also play a role in anticipating the financial impact of carbon regulations (Ardianto et al., 2023). Strong governance creates an open and accountable organisational culture, as highlighted by Yulianti and Waworuntu (2025). These elements support high-quality emissions disclosure by ensuring the integration of environmental issues into the company's long-term strategy, thereby ultimately enhancing the company's credibility and value in the eyes of stakeholders (Bedi and Singh, 2024a; Ratmono et al., 2022).

International standards and guidelines provide a structured framework for GHG emissions reporting, improving the reliability, transparency and consistency of data. The GHG Protocol, as the most widely used global standard, divides emissions into Scope 1 (direct), Scope 2 (indirect from energy), and Scope 3 (other indirect), with the principles of relevance, completeness, consistency, transparency, and accuracy (Xu et al., 2025). The IPCC Guidelines provide guidance on quantifying emissions and addressing uncertainty and data quality assessment, which supports corporate reporting (Mirabella and Allacker, 2021). ISO 14064 emphasises the quantification, reporting, and verification of GHG emissions with a focus on boundary systems and data quality (Jusoh et al., 2018). TCFD and GRI 305, together with the GRI Guidelines, ensure transparency and comparability across organisations (Alrazi et al., 2018; Bianchini et al., 2023). The CDP and DEFRA frameworks provide clear methodologies for measuring and disclosing emissions (Liu et al., 2023). Alrazi et al. (2018) and Bais et al. (2024) emphasise that the adoption of GRI Guidelines improves the quality and scope of reporting by ensuring that data is presented in a balanced, comparable, and reliable manner. Luo et al. (2021) state that these standards can reduce information asymmetry and support stakeholder trust. However, the lack of harmonisation between standards leads to differences in gas-to-CO_2e conversion, boundary systems, and reporting scope, which hinders inter-company comparisons (Cenci and Biffis, 2025). Solutions to these challenges include the development of standardised carbon data collection methodologies, uniform data formats, efficient processes, and transparent data sharing protocols (Ströher et al., 2025; Xu and MacAskill, 2024). Governments also have a role to play in establishing uniform guidelines to ensure consistency in reporting across industries (Long et al., 2023; Tang et al., 2022).

Rewards and penalties in the form of Incentives and sanctions are the main drivers for companies to disclose their emissions data honestly and comprehensively. In terms of incentives, carbon emissions trading policies motivate companies to innovate in green technology and report emissions transparently through cost compliance and innovation compensation mechanisms (Wu et al., 2023). While the carbon emissions trading scheme encourages green investment, especially in large and state-owned companies, with the support of internal incentives such as executive compensation that reinforces reporting transparency (Chen et al., 2023). Financial incentives in the form of tax reductions and subsidies further encourage company participation in carbon reporting programmes (Abdalla et al., 2024a; Sun et al., 2025; Sun et al., 2025), as seen in China's value-added tax reform, which successfully reduced sulphur dioxide emission intensity by 16.6% through the adoption of clean technology and motivated accurate emissions reporting (Qi et al., 2023). The proposed corporate carbon tax in the United States also aims to improve environmental compliance by providing incentives for sustainable practices (Altaf and Dodamani, 2024), while executive compensation linked to carbon targets directs management focus towards long-term sustainability and increases transparency (Sun et al., 2025). On the other hand, sanctions in the form of environmental penalties have been shown to encourage carbon disclosure, especially among companies with sufficient financial resources, with social media scrutiny reinforcing public pressure for honest reporting (He et al., 2023; Shao et al., 2025). Coercive regulatory pressure, such as reporting requirements in the UK, forces companies to disclose emissions even though the impact on emission reductions is limited without adequate incentives (Tang and Demeritt, 2018), while mandatory regulations in some Chinese provinces encourage CO_2 emission reductions and motivate accurate reporting to avoid penalties (Xu and Xu, 2022). Ultimately, a balanced combination of incentives and sanctions—tailored to factors such as company size, ownership structure, and level of external oversight—ensures more effective carbon transparency than the implementation of a single policy (He et al., 2022; Hu and Xu, 2025; Li et al., 2024).

These supporting factors interact to create an ecosystem that supports high-quality GHG emissions disclosure. External audits and verification ensure that the data disclosed is reliable, supported by standards and guidelines that provide a consistent reporting framework. Technology and innovation improve the efficiency and accuracy of data collection, enabling companies to meet standards and obtain incentives. Strengthened governance creates an organisational culture that supports transparency, ensuring that technology and verification are integrated into corporate strategy. Rewards and penalty encourage compliance with standards and the adoption of green technology, while strong governance ensures that incentives and sanctions are applied effectively. This synergy creates a virtuous circle that improves the quality of GHG emissions disclosure, supporting the transition to a more transparent and responsible low-carbon economy.

3.5. Outcomes of GHG Emissions Disclosure

GHG emissions disclosure has a positive impact on companies, including increased competitive advantage, reputation, company value, reduced capital costs, and improved financial performance. These key results are shown in Table 5. Disclosure of greenhouse gas emissions has become a strategic instrument for companies to create differentiation and build competitive advantage in the market. Transparency in emissions reporting allows companies to highlight their commitment to sustainability, which effectively distinguishes them from poorly performing competitors (Radu et al., 2020). Liu et al. (2025b) and Zheng et al. (2025) show that strict regulations encourage green innovation that strengthens competitive positions through more sustainable products or processes. The positive impact of this disclosure is evident in its relationship with various stakeholders. Karim et al. (2021) and Ma et al. (2024) emphasise that transparency strengthens trust by demonstrating a solid environmental record, while competitive companies are often perceived as having lower risk

Table 5: Outcomes of GHG emissions disclosure

Theme	Description	Key points
Competitive advantage	The ability of carbon/sustainability disclosure to create strategic differentiation and competitive advantage through the development of competitive carbon strategies, the publication of strong environmental records to stakeholders, and differentiation from poorly performing companies	High-quality carbon disclosure enables organisations to develop competitive carbon strategies Environmental activities enhance organisational trust and build a reputation for competitive advantage Helps companies differentiate themselves from poorly performing companies to avoid adverse selection issues
Legitimacy and reputation	The role of carbon/sustainability disclosure in meeting stakeholder demands, reducing information asymmetry, and building social legitimacy and corporate reputation in the eyes of stakeholders	Meeting stakeholder demands for environmental reporting provides economic benefits through reputation protection and enhancement Reduces information asymmetry between stakeholders and company management Enhancing the company's reputation in the capital market and building investor confidence
Increased company value	The contribution of carbon/sustainability disclosure to increased market valuation and company value through positive signals to investors and the capital market	Carbon disclosure has been shown to increase firm value Helping companies differentiate themselves and increase their market value Positive association with higher company value and economic preservation
Decreased cost of capital	The impact of carbon/sustainability disclosure on reducing the cost of capital through improved environmental risk management practices, regulatory risk mitigation, and increased access to financing	Voluntary carbon disclosure is associated with lower overall capital costs Better environmental risk management practices reduce market risk and capital costs Disclosure of corporate social performance is associated with lower long-term debt ratios
Stronger financial performance	Positive relationship between carbon/sustainability disclosure and improved corporate financial performance, both in terms of accounting measures and market measures	Strong evidence that voluntary carbon disclosure is positively associated with corporate financial performance Carbon disclosure is more positively associated with corporate accounting measures Improved operational performance and profitability

Source: Author's elaboration

by creditors (Peng, 2023). Kim (2025) adds that a reputation as a responsible business attracts customers and investors who prioritise sustainability, and Song et al. (2024) find that transparent companies are more attractive to business partners committed to sustainability.

High-quality GHG emissions disclosure has been shown to enhance a company's legitimacy and reputation in the eyes of key stakeholders such as investors, regulators, and the public. Liesen et al. (2017) demonstrate that transparent disclosure strengthens a company's reputation and reduces information asymmetry. By reporting clear emissions data, companies demonstrate their commitment to environmental responsibility, which in turn increases trust from investors, customers, and the public (Chithambo et al., 2021). Budianto et al. (2025) and Jiang et al. (2022) emphasise that this disclosure provides economic benefits, particularly through the protection and enhancement of a company's reputation. Detailed carbon reports help companies gain social recognition, which is important for maintaining their operational legitimacy (Liu et al., 2023; Tang et al., 2022). This transparency reduces information asymmetry, which ultimately strengthens confidence in the capital market (Dhanda and Malik, 2020; Hu and Liang, 2024).

Disclosure of GHG emissions contributes to an increase in company value through several mechanisms. Transparency in emissions reporting sends a positive signal to the market, which leads to higher market valuations (Huang et al., 2025; Lee and Cho, 2021). Assidi (2023) shows that voluntary disclosure tends to have a positive impact on company value, while mandatory disclosure can have a negative impact if it is not balanced with quality disclosure (Kim, 2024). More transparent emissions disclosure increases company value, especially when companies have good environmental performance and are in sectors that are sensitive to environmental issues (Hardiyansah et al., 2021). In addition, the positive effects of emissions disclosure are more pronounced in the long term, especially for companies that are under strict supervision or have clear regulations (Ganda, 2022). Transparent GHG emissions disclosure increases company value by sending positive signals to investors and capital markets, which is reflected in higher market valuations. Alsaifi et al. (2019) and Blanco (2021) state that this disclosure allows companies to differentiate themselves, which in turn increases market value. Chao et al. (2025) and Dan et al. (2023) add that consistency between carbon performance and disclosure reinforces the positive impact on firm value.

Transparent GHG emissions reports can lessen a firm's capital costs, including both equity and debt costs. Open emissions reporting can garner investor and creditor trust. This minimizes information mismatches and decreases the risk premium the market imposes (Bui et al., 2020; Xu et al., 2025). Lemma et al. (2018) and Palea and Drogo (2020) demonstrated that lower capital costs accompany voluntary carbon disclosure, showing effective management of environmental risk, and less risk for investors and creditor.

This type of communication lessens the asymmetry of information, thus reducing the risk that creditors perceive

(Dhanda and Malik, 2020; Hu and Liang, 2024). In the case of the most pronounced decrease in the cost of capital, this is observed in the most polluting industries and in countries that abide to sustainable finance principles (Palea and Drogo, 2020). Complete and verified emissions disclosures have a far greater influence on capital cost reduction, particularly when aligned to international standards (Saka and Oshika, 2014). Moreover, GHG emissions disclosures facilitate easier, lower-cost borrowing and contribute to a decrease in the proportion of long-term debt as creditors identify the risk of a weaker environment, in part by reducing market risk and increasing the liquidity of a company's stock (Lemma et al., 2018; Morrone et al., 2022). Underlying the comments of both Blanco (2021) and Luo et al. (2021) is the finding that corporate social performance disclosures are linked to lower long-term debt ratios and decreased debt financing costs.

Disclosure of GHG emissions has been shown to have a significant positive impact on corporate financial performance. A meta-analysis of 34 studies shows that companies with lower GHG emissions tend to have better financial performance, both in terms of accounting metrics such as operating profit and market metrics such as share value (Galama and Scholtens, 2021). In the UK, a study by Alsaifi et al. (2019) on FTSE350 companies shows that voluntary carbon disclosure is positively correlated with accounting measures such as profit, especially when supported by quality disclosure (Mardini & Lahyani, 2024). In countries with strict carbon policies, emissions disclosure is positively associated with long-term financial performance (Siddique et al., 2021). This disclosure improves stock performance, particularly under institutional pressure such as strict climate policies (Bimha and Nhamo, 2017; Liu et al., 2025b), in line with findings in Australia, where voluntary GHG disclosure is positively associated with return on assets (ROA) in the year following disclosure (Borghei et al., 2018). Meanwhile, Xu et al. (2025) and Wang et al. (2022) show that carbon transparency also improves operational efficiency and attracts sustainability-conscious investors. Overall, transparent and comprehensive GHG emissions disclosure can improve a company's financial performance, especially when supported by comprehensive disclosure and good environmental performance (Chithambo et al., 2020; Ganda, 2018).

These positive impacts interact with each other to create a positive cycle that supports the company's sustainability. The competitive advantage generated by carbon strategies strengthens legitimacy and reputation, as an innovative and responsible corporate image increases stakeholder trust. Legitimacy and reputation support increased company value, as market confidence increases valuation. Increased company value and reduced capital costs are interrelated, as companies with high valuations often obtain cheaper financing, which in turn supports better financial performance. Strong financial performance reinforces all other elements, as high profitability enables companies to invest in carbon strategies, maintain legitimacy, and increase market valuation. This synergy confirms that GHG emissions disclosure is a strategic investment that generates mutually reinforcing economic and social benefits.

4. DISCUSSION

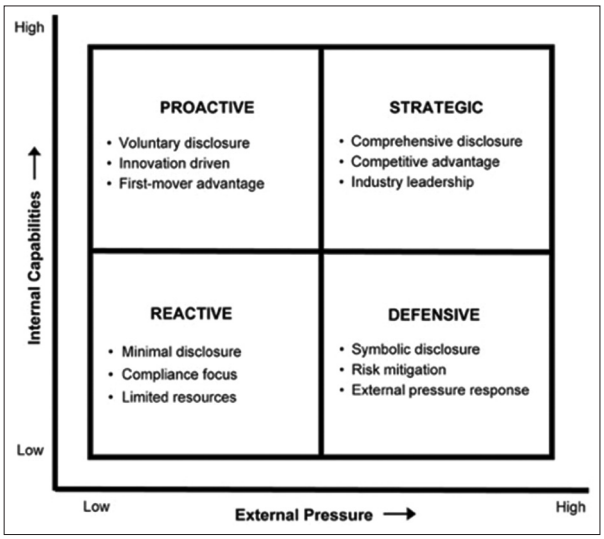
The expansion of corporate GHG emissions disclosure has become intricately complex and multifaceted. Understanding this dimension of corporate communication requires consideration of numerous theoretical approaches. The matrix model of strategic emissions disclosure (Figure 6) integrates multiple theories in order to explain the diversity of corporate emissions disclosure developed through the analysis of 128 empirical studies. The two most critical elements within this model— external pressure and internal capability—determine corporate emissions disclosure.

4.1. Interpretation of Quadran and Strategy Dynamics

The reactive quadrant (Low-Low) exhibits a condition of organisational inertia with both external and internal pressure at low levels. Companies occupying such a position experience a lack of urgency in GHG emission disclosures and lack the internal resources to track GHG emissions, largely due to the expensive emission monitoring system's contraption (Datt et al., 2019) and the unreliable emission data (Abdalla et al., 2024a). This is referred to as the "avoidance" strategy in Oliver (1991), which describes such a scenario in which companies do barely more than the minimum required. This situation is more likely to be found in small and medium sized companies or in countries with poorly enforced environmental legislation and where there are no or very weak incentives for investments in systems for disclosing GHG emissions.

Moving to the defensive quadrant (High-Low) poses an interesting paradox, which can be explained through Suchman's (1995) Legitimacy Theory. Under-resourced organizations operating in high-pressure environments must respond to external demands to "maintain a licence to operate," while simultaneously contending with an environmental legitimacy deficit (Bansal and Clelland, 2004). With respect to Institutional Theory (DiMaggio and Powell, 1983), organizations under coercive pressure must provide disclosures, even if they are not so inclined. This study corroborates the phenomenon with evidence that "managers"

Figure 6: Strategic matrix of GHG disclosure



Source: Author's elaboration

intent to conceal actual practices of their activities through these mechanisms, as well as deliberate manipulation of stakeholders' (Abdalla et al., 2024a; Giannarakis et al., 2017). This becomes a major hurdle in situations of forced symbolic disclosures and in the practice of greenwashing. Long-established organizations operating under newly imposed comprehensive regulations, as well as suppliers that international buyers pressure to provide disclosures, often find themselves in this defensive position, which the literature describes in the context of data manipulation (Luo et al., 2022).

The Proactive Quadrant (Low-High) represents a forward-looking strategic perspective in which companies with strong capabilities—supported by advanced technology (Chen et al., 2025) and leadership commitment (Yulianti and Waworuntu, 2025)—voluntarily adopt GHG emissions disclosure practices even though external pressure remains low. Freeman's Stakeholder Theory (1984), expanded upon by Mitchell et al. (1997), explains how companies proactively manage stakeholder relationships to build reputational capital before it becomes a mandatory requirement. The Resource-Based View (Barney, 1991) supports this position by showing how strong internal capabilities can create a first-mover advantage, as demonstrated by Xu et al. (2025), who show that proactive disclosure increases investor confidence. Companies with abundant technology and resources or companies with visionary leadership often take this position, preparing for future regulations while building learning advantages.

Lastly, in the strategic quadrant (High-High), companies encounter the most optimal conditions wherein the alignment of fully external pressures (e.g., regulations and stakeholder demands) and strong internal capabilities leads to what Porter and Kramer (2011) define as "joint value creation." As companies deploy and integrate environmental resources into their business processes, they derive what Hart and Dowell (2011) refer to as "Natural Resource-Based View" sustainable competitive advantage. Alsaifi et al. (2020) shows that companies proactively manage and leverage defensible GHG emissions disclosure as a competitive advantage, further melding the concept of high-quality disclosure and competitive strategy, thus market value. Comprehensive disclosure also fits into Signalling Theory (Spence, 1973) wherein it provides a strong signal of environmental capability and commitment to the company.

5. CONCLUSION, IMPLICATION, AND RECOMMENDATION

Based on a systematic literature review, this study concludes that transparency in GHG emissions reporting plays a very important role in corporate sustainability and climate change mitigation. GHG emissions disclosure not only has a positive impact on corporate reputation, but can also reduce capital costs and improve financial performance and corporate value. Although there are many external factors, such as regulations and market pressures that encourage companies to disclose, as well as internal factors, such as governance and organisational culture that influence reporting, the main challenges in its implementation are often related to resource constraints, resistance to cultural change, and technical difficulties in collecting and reporting accurate data.

This study develops an integrative model that links legitimacy, institutional and accountability theories with a resource-based approach in the context of emissions disclosure, highlighting the importance of standardisation, external auditing and governance strengthening to improve disclosure quality. Theoretically, the results of this study enrich legitimacy theory by showing that GHG emissions disclosure is used by companies to maintain their social acceptance in the eyes of stakeholders, as well as strengthening institutional theory by exploring how external and internal factors interact in shaping better disclosure strategies. Companies that implement more transparent disclosure practices can gain the trust of investors, regulators, and the wider community, while making a greater contribution to global climate change mitigation.

In light of these findings, this study recommends several strategies to improve the quality of GHG emissions disclosure. First, companies need to leverage advanced digital technologies such as blockchain, artificial intelligence (AI), and satellite imagery to improve the efficiency of emissions data management and reporting more accurately and transparently, while reducing human error and speeding up the reporting process. Second, it is important for companies to strengthen their governance structures by ensuring diversity on their boards of directors and affirming leadership commitment to transparency, given that the literature review shows that gender diversity and sustainability committees on boards of directors can improve the quality of disclosure. Third, internal training and capacity building within companies are essential to improve understanding of quality emissions disclosure and its impact on long-term company performance. Finally, small companies with limited resources can collaborate with other institutions to share technology and resources, thereby improving their ability to implement more effective reporting systems.

In practice, these findings provide guidance for companies and regulators in designing more transparent policies and strategies for emissions disclosure. However, this study also has several limitations that need to be considered. One of these is the challenge of measuring the direct impact of emissions disclosure on company performance, as the long-term effects of such disclosure are often only visible after several years. Companies with limited resources, both financial and human, may also find it difficult to implement more sophisticated and accurate reporting systems. In addition, resistance to organisational cultural change is a major obstacle, where companies may face difficulties in changing old habits or an established culture of greenwashing. Accurate measurement of the impact of emissions disclosure is also difficult due to gaps in available data, particularly with regard to scope 3 emissions, which are more difficult to track. Another limitation is that this study does not examine in depth the differences in GHG emissions disclosure across different industrial sectors, which may have other challenges and needs, as well as differences in regulations between countries that may affect disclosure.

6. FUTURE RESEARCH

In the future, further research is needed to test and verify the proposed framework in various industrial contexts and corporate environments. Empirical investigations will help identify more detailed implementation challenges and provide stronger evidence of the effectiveness of the proposed disclosure strategies. Such research should also explore in greater depth how companies can overcome organisational cultural barriers, particularly resistance to change focused on sustainability and transparency. Further research could integrate grey literature, including industry reports, government policies, and company reports that are highly relevant to practical applications, although this integration must be done with caution given the challenges related to source quality and methodological transparency. Finally, further research could also examine the impact of GHG emissions disclosure on other aspects of corporate governance, such as ethical decision-making, risk management, and compliance, which in turn would strengthen transparency and accountability in corporate governance practices. Although technology can help address some of these challenges, a strong commitment from management is still necessary to support sustainable change and ensure effective integration into everyday business practices.

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APPENDIX

Appendix: The inter-rater reliability (IRR) Values and details of the research contributions

Author (Year)	DOI	IRR		Contribution			
		Agreement (%)	Disagreement (%)	D	B	E	O
Abd Majid & Jaaffar (2023)	10.3390/su15118491	99.31	0.69	3	0	1	0
Abdalla *et al*. (2024a)	10.46754/jssm. 2024.02.009	96.62	3.38	6	2	3	0
Abdalla *et al*. (2024b)	10.46754/jssm. 2024.02.003	98.22	1.78	4	3	2	0
Abdullah *et al*. (2020)	10.32479/IJEEP. 10142	97.95	2.05	7	0	0	0
Adetutu *et al*. (2024)	10.1111/obes. 12633	99.03	0.97	1	2	3	0
Akbaş & Canikli (2019)	10.3390/su11010107	97.38	2.62	9	1	1	0
Alrazi *et al*. (2018)	10.14419/ijet.v7i4.35.23111	97.90	2.10	3	0	2	0
Alsaifi *et al*. (2019)	10.1002/bse. 2426	98.93	1.07	0	0	0	4
Alsaifi *et al*. (2020)	10.1016/j.jclepro. 2020.121377	99.24	0.76	1	1	0	1
Ardianto *et al*. (2023)	10.1002/csr. 2671	99.44	0.56	2	0	2	0
Asif *et al*. (2023)	10.3389/fsufs. 2023.1214490	99.84	0.16	0	1	0	0
Barusman *et al*. (2020)	Unassigned	96.40	3.60	2	1	0	0
Bedi & Singh (2024a)	10.1108/MRR-01-2023-0015	94.66	5.34	13	0	4	0
Bedi & Singh (2024b)	10.1108/SRJ-08-2023-0454	98.46	1.54	4	1	0	1
Ben-Amar *et al*. (2017)	10.1007/s10551-015-2759-1	99.22	0.78	2	0	0	0
Bimha & Nhamo (2017)	10.1002/sd. 1670	99.40	0.60	0	0	1	1
Blanco *et al*. (2017)	10.1016/j.bushor. 2017.05.007	99.10	0.90	3	0	0	0
Blanco (2021)	10.1111/poms. 13421	98.52	1.48	3	2	1	1
Budianto *et al*. (2025)	10.24112/jaes. 090006	97.00	3.00	5	0	6	1
Bui *et al*. (2020)	10.1016/j.bar. 2019.100880	98.57	1.43	1	2	4	1
Cai *et al*. (2024)	10.1108/PAR-04-2023-0055	98.88	1.12	3	3	0	0
Chao *et al*. (2025)	10.1371/journal.pone. 0319997	96.16	3.84	3	2	3	2
Chen *et al*. (2025)	10.1016/j.ijpe. 2024.109445	97.73	2.27	0	2	8	0
Dai & Sun (2025)	10.1016/j.frl. 2024.106651	99.57	0.43	0	0	1	0
Dan & Shen (2022)	10.3390/su14052714	99.06	0.94	2	2	0	0
Dan *et al*. (2023)	10.3390/su15054612	98.11	1.89	2	3	0	2
Datt, Ragini (2019)	10.1108/ARJ-02-2017-0031	97.44	2.56	3	4	3	0
Dhanda & Malik (2020)	10.1111/basr. 12207	96.08	3.92	4	2	2	1
Dharma *et al*. (2024)	10.32479/ijeep. 15915	99.58	0.42	1	0	0	1
Ding *et al*. (2023)	10.1007/s10551-022-05292-x	99.68	0.32	2	0	0	0
Florackis *et al*. (2025)	10.1016/j.intfin. 2025.102113	98.93	1.07	3	2	0	0
Frisch (2024)	10.1016/j.erss. 2024.103704	98.74	1.26	1	4	0	0
Gerged *et al*. (2020)	10.1002/bse. 2661	99.44	0.56	1	0	2	0
Ghosh *et al*. (2024)	10.1007/s10690-023-09428-5	99.44	0.56	1	0	0	1
Giannarakis *et al*. (2017)	10.1002/bse. 1962	99.74	0.26	0	0	1	0
Gonenc & Krasnikova (2022)	10.3390/su142114418	96.51	3.49	12	0	2	0
Grauel & Gotthardt (2016)	10.1016/j.jclepro. 2016.05.182	99.26	0.74	2	0	2	0
Guenther *et al*. (2016)	10.1177/0007650315575119	99.09	0.91	5	0	0	0
Guo & Pan (2022)	10.3390/ijerph 192417053	98.17	1.83	6	0	0	1
Hassan & Romilly (2018)	10.1002/bse. 2040	99.25	0.75	1	1	0	1
He *et al*. (2023)	10.1007/s11356-023-28883-1	98.81	1.19	0	1	4	0
Herold & Lee (2017)	10.3390/su9040601	99.75	0.25	0	1	0	0
Hollindale *et al*. (2017)	10.1111/acfi. 12258	98.32	1.68	3	0	2	0
Hollindale *et al*. (2022)	10.1111/acfi. 12906	99.60	0.40	0	0	2	0
Hoştut & Deren van het Hof (2020)	10.1108/SRJ-11-2019-0377	98.51	1.49	3	1	2	1
Hsueh (2019a)	10.1002/bse. 2317	99.87	0.13	1	0	0	0
Hsueh (2019b)	10.1007/s11149-019-09390-z	98.81	1.19	2	1	4	0
Hu & Liang (2024)	10.1016/j.cjpre. 2024.03.009	98.71	1.29	1	1	0	2
Huang *et al*. (2025)	10.3390/su17020402	97.82	2.18	1	1	1	4
Jiang *et al*. (2024)	10.1016/j.irfa. 2024.103670	97.43	2.57	0	4	9	0
Jiang *et al*. (2022)	10.1111/jifm. 12161	99.01	0.99	2	0	3	1
Jin *et al*. (2021)	10.3390/su132413532	99.15	0.85	4	0	0	0
Karim *et al*. (2021)	10.1016/j.jenvman. 2021.112581	98.78	1.22	2	0	0	2
Kaupa (2025)	10.54648/eulr2025041	99.62	0.38	2	0	0	0
Khalid *et al*. (2022)	10.1080/17583004.2022.2083983	98.75	1.25	3	2	0	0
Kılıç & Kuzey (2019)	10.1108/IJCCSM-07-2017-0144	98.71	1.29	4	0	0	0
Kim (2025)	10.53894/ijirss.v8i2.5727	98.91	1.09	0	0	0	2
Kim (2024)	10.55214/25768484.v8i6.3042	92.66	7.34	2	5	1	5
Lan *et al*. (2025)	10.1016/j.iref. 2025.104170	98.81	1.19	1	0	1	0
Lee & Cho (2021)	10.3390/ijerph 182212166	98.20	1.80	2	0	0	7
Lee (2022)	10.3390/su14127504	99.78	0.22	0	0	1	0
Lemma *et al*. (2018)	10.1002/bse. 2242	98.16	1.84	1	1	2	4
Lemma *et al*. 2020)	10.1108/IJAIM-06-2019-0064	98.28	1.72	2	0	1	1

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Appendix: ***(Continued)***

Author (Year)	DOI	IRR		Contribution			
		Agreement (%)	Disagreement (%)	D	B	E	O
Li *et al*. (2018)	10.1007/s10551-016-3187-6	98.73	1.27	2	0	1	0
Liao *et al*. (2015)	10.1016/j.bar. 2014.01.002	99.35	0.65	1	1	1	0
Liesen *et al*. (2017)	10.1111/jbfa. 12217	99.26	0.74	2	1	2	0
Linares-Rodríguez *et al*. (2022)	10.1016/j.jclepro. 2022.132850	99.01	0.99	4	0	0	0
Liu & Li (2019)	10.3390/ijerph 16234777	99.09	0.91	1	1	0	0
Liu, *et al*. (2025a)	10.3390/ijfs13020098	99.50	0.50	2	0	1	0
Liu, *et al*. (2025b)	10.3390/su17062597	98.55	1.45	4	2	1	0
Liu, *et al*. (2025c)	10.3390/risks13050092	96.70	3.30	3	2	8	10
Liu & Yang (2018)	10.1108/CG-11-2016-0213	95.84	4.16	2	9	2	0
Liu *et al*. (2023)	10.1016/j.irfa. 2023.102846	99.06	0.94	2	2	1	2
Liu & Cheng (2023)	10.1007/s11356-022-23554-z	98.86	1.14	3	2	1	1
Long *et al*. (2023)	10.1016/j.resconrec. 2023.106970	98.89	1.11	1	3	1	2
Luo & Tang (2014)	10.1016/j.jcae. 2014.08.003	98.32	1.68	1	3	1	0
Luo *et al*. (2023)	10.1111/acfi. 13060	98.46	1.54	1	2	7	1
Luo *et al*. (2021)	10.1080/17583004.2021.1899755	95.93	4.07	2	7	3	1
Luo *et al*. (2022)	10.1080/17583004.2021.2022537	97.12	2.88	2	8	1	0
Ma *et al*. (2023)	10.1016/j.gr. 2023.02.002	99.84	0.16	1	0	0	0
Ma (2025)	10.1016/j.frl. 2025.107524	97.63	2.37	3	0	2	1
Ma *et al*. (2023)	10.3390/su15065240	99.45	0.55	0	0	3	0
Ma *et al*. (2024)	10.1016/j.jbusres. 2023.114467	98.44	1.56	1	4	0	2
Mansour *et al*. (2025)	10.1007/s43621-025-01405-4	98.99	1.01	3	2	1	0
Manurung *et al*. (2022)	10.5890/JEAM.2022.12.001	96.03	3.97	4	1	3	0
Mardini & Lahyani (2024)	10.1108/SEF-02-2023-0056	97.99	2.01	4	0	2	1
Mateo-Márquez *et al*. (2021)	10.3390/su13041914	97.27	2.73	2	1	7	0
Mateo-Márquez *et al*. (2022)	10.1016/j.jclepro. 2022.132567	99.75	0.25	0	1	0	0
Mia *et al*. (2021)	10.3390/su132313282	99.41	0.59	1	0	1	0
Momin *et al*. (2017)	10.1108/JAOC-07-2015-0054	99.41	0.59	3	1	0	0
Mora Rodríguez *et al*. (2020)	10.1108/JFRA-01-2020-0002	98.96	1.04	0	1	0	1
Ott *et al*. (2017)	10.1016/j.jaccpubpol. 2016.11.003	99.60	0.40	1	1	0	0
Palea & Drogo (2020)	10.1002/bse. 2550	99.27	0.73	1	1	1	2
Patel *et al*. (2024)	10.22495/cbsrv5i3art15	98.58	1.42	0	3	0	0
Peng *et al*. (2014)	10.1111/twec. 12187	96.99	3.01	8	0	2	0
Peng (2023)	10.4018/IJITSA.326756	94.15	5.85	3	0	1	1
Peng *et al*. (2023)	10.3389/fenvs. 2023.1204970	98.87	1.13	0	1	2	0
Pinheiro *et al*. (2022)	10.24857/rgsa.v16.2866	98.50	1.50	6	0	0	0
Puspita *et al*. (2024)	10.32479/ijeep. 15377	99.60	0.40	0	0	1	0
Radu *et al*. (2020)	10.1016/j.jclepro. 2019.118681	99.58	0.42	1	0	0	1
Rahman *et al*. (2019)	10.1002/bse. 2302	99.38	0.62	1	0	1	0
Rahmawati *et al*. (2024)	10.32479/ijeep. 15031	98.35	1.65	3	1	0	0
Saha & Maji (2025)	10.1016/j.jenvman. 2025.125809	99.71	0.29	1	0	0	0
Saka & Oshika (2014)	10.1108/SAMPJ-09-2012-0030	98.44	1.56	5	0	0	0
Shao & He (2022)	10.3389/fevo. 2022.971077	99.37	0.63	2	0	0	0
Shao *et al*. (2025)	10.3389/fenvs. 2024.1426046	98.60	1.40	5	1	1	0
Siddique *et al*. (2024)	10.1108/JAAR-08-2022-0215	98.52	1.48	5	0	1	0
Sisdianto *et al*. (2024)	10.59953/paperasia.v40i6b. 136	99.75	0.25	0	0	0	1
Sun *et al*. (2025a)	10.1016/j.iref. 2025.104242	97.23	2.77	2	0	6	1
Sun *et al*. (2025b)	10.1016/j.jenvman. 2025.126369	98.02	1.98	2	1	4	0
Tang *et al*. (2020)	10.1080/1540496X.2019.1689356	95.59	4.41	8	3	3	0
Tang *et al*. (2022)	10.3390/ijerph 19074174	96.16	3.84	4	3	7	3
Tarigan *et al*. (2022)	10.13106/jafeb. 2022.vol9. no4.0251	99.35	0.65	1	0	0	1
Tauringana & Chithambo (2015)	10.1016/j.bar. 2014.07.002	99.24	0.76	2	2	0	0
Tian *et al*. (2024)	10.3390/su16198448	98.57	1.43	1	3	1	2
Tingbani *et al*. (2020)	10.1002/bse. 2495	99.04	0.96	0	0	4	0
Velte (2025)	10.1002/csr. 3153	99.11	0.89	1	0	2	0
Wang *et al*. (2022)	10.3390/su14159159	99.25	0.75	2	0	0	1
Wang *et al*. (2023)	10.1016/j.jclepro. 2023.138858	99.43	0.57	0	0	0	2
Xu *et al*. (2025)	10.1371/journal.pone. 0313638	97.60	2.40	1	2	4	2
Yin *et al*. (2023)	10.3390/su152115296	99.65	0.35	2	0	0	0
Yuan *et al*. (2022)	10.1007/s11356-022-20705-0	99.23	0.77	1	1	1	1
Yulianti & Waworuntu (2025)	10.1007/s40745-024-00564-x	97.91	2.09	5	1	2	0
Zhang (2024)	10.3389/fclim. 2024.1469899	99.26	0.74	2	1	0	0

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Appendix: ***(Continued)***

Author (Year)	DOI	IRR		Contribution			
		Agreement (%)	Disagreement (%)	D	B	E	O
Zhao *et al*. (2025)	10.1016/j.susoc. 2025.02.001	99.69	0.31	2	0	0	0
Zheng *et al*. (2025)	10.1016/j.jenvman. 2025.125218	95.36	4.64	5	1	6	4
Zhu *et al*. (2024)	10.1016/j.frl. 2024.105951	98.29	1.71	2	1	1	0
Zhu *et al*. (2025)	10.1016/j.eneco. 2025.108207	98.23	1.77	1	1	4	0