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Quality of Environmental Sustainability Reporting in Container Shipping

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Abstract

The quality of sustainability reporting (QSR) has become a focal point for both scholars and practitioners, largely due to heightened concerns surrounding corporate transparency and the risk of "greenwashing." QSR comprises dimensions such as materiality, credibility, completeness, and assurance, ensuring that disclosed information is both relevant and reliable. This study investigates QSR dimensions in the container shipping industry, emphasizing the disclosure of environmental materiality and the extent to which external assurance is employed. Through conceptual content analysis of 47 sustainability reports published between 2018 and 2022 by the world's top ten container shipping companies, the findings indicate that, although firms dedicate considerable attention to emissions and energy consumption, other issues (e.g., biodiversity, effluents) are comparatively underrepresented. Moreover, only a subset of these environmental disclosures undergoes external assurance, and the analysis focuses on the presence of assurance rather than the specific scope or type of engagements, which further calls into question the overall reliability and comprehensiveness of the reported information. The results highlight the need for more robust and standardized assurance frameworks and for closer scrutiny of QSR to enhance stakeholder confidence in container shipping's sustainability reporting.

Keywords: *Sustainability Reporting Quality, Container Shipping, Materiality, Assurance*

JEL Codes: Q50, Q56, N70, M42,

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1. Introduction

Global interest in sustainability has accelerated (Lo & Sheu, 2007; Ahmad et al., 2024; Nostrabadi et al., 2019). Reporting trends mirror this surge: among the world's 250 largest revenue firms listed in the 2021 Fortune 500, the share issuing sustainability reports rose from 35 percent in 1999 to 96 percent in 2022 (KPMG, 2022). Even with the substantial growth in corporate sustainability reporting, questions about the quality of the information released have not abated (Michelon et al., 2015:59–60; Khan et al., 2021).

Sustainability reporting functions as a vehicle for organizations to signal commitment to sustainable development and to track progress toward sustainable finance objectives (Dilling, 2010; Siew, 2015). At the same time, critics argue that many reports amount to opportunistic greenwashing, suffer from credibility deficits, overlook stakeholder concerns, and fall short of user needs (Burritt & Schaltegger, 2010; Thorne et al., 2014; Leung et al., 2015; Khan et al., 2021).

Greenwashing refers to a deliberate strategy in which organizations foreground favourable environmental or social outcomes while muting or hiding harmful effects to cultivate an excessively positive image (Lyon & Maxwell, 2011, pp. 7–8; Garst et al., 2022, p. 66). Because early uptake of sustainability reporting was largely voluntary and stakeholder and shareholder expectations have continued to evolve across sectors, a single universally accepted international standard has yet to emerge (Jose, 2017). Many firms follow multiple sustainability standards, which introduce challenges for the overall quality of their reports (De Micco, 2021; Brusca et al., 2018). A core stumbling block is materiality determination: deciding which sustainability issues carry the greatest weight and elevating those topics within the report (Jorgensen et al., 2022; Beske et al., 2020). Skepticism among stakeholders also persists, with sustainability reports frequently viewed as instances of corporate greenwashing (Adams & Evans, 2004; Farooq & De Villiers, 2017; Farooq et al., 2024). In the absence of external assurance, credibility concerns intensify and the information provided may be inadequate for stakeholder decision-making (Carrington, 2019; Boiral et al., 2019a; Boiral et al., 2019b).

External assurance is central to the quality of sustainability reporting because it increases the credibility of disclosures and helps stakeholders make better informed decisions (Simnett et al., 2009; Hummel & Schlick, 2016; Manetti & Becatti, 2009). When this level of quality is absent, sustainability reporting does not adequately support stakeholders' evaluations, which lowers its value for decision making (Gao et al., 2016, p. 290; Khan et al., 2021, p. 339).

High-quality reporting matters: if disclosures are both material and reliable, stakeholder skepticism diminishes and a firm's external reputation improves (Cormier et al., 2005, p. 9; Michelon et al., 2015, p. 73). In the financial domain,

materiality arose as a criterion for identifying items whose omission or misstatement could affect investor decisions, and it functions as a foundational principle guiding both the preparation and the audit of financial statements (Messier et al., 2005; Fasan & Mio, 2017; Edgley, 2014; Farooq et al., 2021). More recently, materiality has been applied to sustainability reporting as well, where it continues to guide decision-making (Jones et al., 2016; Calabrese et al., 2017). A range of standards now steer sustainability reporting, each with its own way of defining what counts as material. Under GRI 3 (Material Topics 2021), for example, an organization must describe within its specific context how it determined the potential and actual impacts of each topic, both positive and negative, on the economy, the environment, people, and human rights (GRI, 2021). Under the IFRS Sustainability Disclosure Standards, a sustainability matter is deemed material when it creates or could create financial risks or opportunities for the company (IFRS, 2023a).

Articles 19a (1) and 29a (1) of Directive 2013/34/EU require companies to disclose both their activities and the consequences of those activities in areas such as environmental protection, social and employee matters, human rights, anti-corruption and bribery (European Union, 2013). This mandate adopts a double materiality view: firms are expected to report their impacts on people and the environment, and the risks that sustainability issues pose to the organization. Because the idea is often misinterpreted, companies should determine and disclose material topics from both angles (European Union, 2022; GRI, 2023).

In sustainability reporting, an assurance engagement is an independent check of ESG information, metrics, and activities, in which a third party gathers sufficient and appropriate evidence to boost stakeholder confidence in the reported material (IAASB, 2021). Assurance and materiality move together: organizations are expected to provide dependable, high-quality accounts of both how sustainability issues affect the firm and how the firm affects people and the environment, in financial and non-financial terms. As demand grows for assured sustainability reports, this linkage strengthens further (Hummel & Schlick, 2016; Simnett et al., 2009; Manetti & Becatti, 2009).

Stakeholder expectations increasingly hinge on two pillars: clear judgments about what is material and independent checks on what is reported. Firms are now assessed for environmental and social impacts as well as financial performance, and stakeholders are calling more often for third-party assurance of those disclosures. In this context, thorough materiality analysis combined with external assurance has become indispensable for strengthening the credibility and overall quality of sustainability reports (Perego & Kolk, 2012; KPMG, 2020, p. 23; Adams et al., 2023). As sustainability challenges differ markedly across industries, sector agendas are widening, and stakeholders increasingly insist on isolating and elevating each sector's distinctive concerns (Eccles et al., 2012). Since its creation in 1959, the International Maritime Organization (IMO) has placed the maritime sector under a dense web of sustainability rules, with a primary emphasis on

preventing and controlling pollution arising from shipping activities (International Maritime Organization, 2019). An early comprehensive benchmark is the 1973 International Convention for the Prevention of Pollution from Ships (MARPOL), a foundational treaty addressing ship-borne pollution in a holistic manner. The IMO 2020 regulation also, in force since 1 January 2020, lowered the global sulphur limit in marine fuels from 3.50% to 0.50%. This change has led shipowners to rely more on low-sulphur fuels, install exhaust gas cleaning systems and, in some cases, switch to alternatives such as LNG to reduce sulphur emissions (International Maritime Organization, 2020).

International trade is broadly recognized as a major engine of global carbon output, responsible for roughly 20–30% of worldwide CO_2 emissions (WTO, 2021; Peters et al., 2011; Meng et al., 2018; Zhang et al., 2020). Seaborne transport is central to this picture: roughly four-fifths of world merchandise moves by sea (Placek, 2023). Container-ship capacity alone expanded from about 11 million metric tons in 1980 to approximately 293 million by 2022.

Although shipping has long been viewed as the least harmful transport mode, recent evidence shows it is a substantial source of greenhouse gases and hazardous pollutants, raising concerns about human health (Nusa & Kodak, 2023). These concerns motivate a closer examination of how well the maritime container sector discloses environmental performance. Accordingly, this study assesses the quality of such disclosures, using materiality and external assurance as key indicators of sustainability reporting quality. In the subsequent sections of the paper, the literature review is presented in Section 2, followed by a detailed description of the data used in the study in Section 3. Section 4 outlines the research methodology, while Section 5 discusses the study's findings. Finally, Section 6 provides the conclusion.

2.Literature Review

In the Web of Science, Scopus, and Google Scholar databases, keywords such as ‘Sustainability Reporting,' 'Materiality,' 'Assurance,' and 'Container Shipping', 'Quality of the Sustainability Reporting' were individually and collectively examined. According to the results, it was determined that, to the best of our knowledge, no publications have been made on the quality of environmental sustainability disclosures on the basis of materiality and assurance within the container shipping industry.

Many academics question the quality of the corporate sustainability disclosures. They argue that these reports, rather than offering an accurate depiction of organizational practices, often amount to little more than symbolic form (Michelon et al., 2015, p.59; Cho et al., 2015; Chelli et al., 2019; Khan et al.,2021). Academic researchers have attempted to understand and define the quality of sustainability reporting in different settings.

2.1. Evolution of Sustainability Reporting

Sustainability reporting is commonly traced to the WCED's 1987 Brundtland Report, *Our Common Future*, which introduced the modern notion of sustainability and outlined a development model integrating environmental, social, and economic dimensions (United Nations, 1987). Building on that foundation, the Global Reporting Initiative, founded in 1997, has driven corporate transparency through guidance first issued in 2000 and updated repeatedly, most recently as GRI 2021 (GRI, 2024a).

Introduced in 1999, the AA1000 AccountAbility Standards set out structured practices for evaluating and communicating sustainability performance (AccountAbility, 2024). In 2000, the United Nations Global Compact called on companies to align their disclosures with ten principles covering human rights, labor, environmental stewardship, and anti-corruption (UNGC, 2024). By the turn of the millennium, these standard-setting efforts and global initiatives had begun to shape sustainability reporting, promoting greater consistency and uptake across firms.

Frameworks that integrate sustainability and financial reporting were advanced by the IIRC, SASB, and TCFD (International Financial Reporting Standards, 2024; SASB, 2024; TCFD, 2018). In 2015, two global milestones reinforced this direction: the UN Sustainable Development Goals, setting 17 goals and 169 targets, and the Paris Agreement, which seeks to limit warming to well below 2°C (United Nations, 2015; United Nations, 2022).Throughout the 2010s, standard-setters shifted toward three priorities: sector-specific requirements, deeper integration of financial and sustainability reporting, and codified disclosure of climate-related financial risks within sustainability frameworks.

Since 2020, the focus has moved toward aligning international reporting rules, driven by the European Green Deal and the Corporate Sustainability Reporting Directive (CSRD) (European Commission, 2021, 2023a). In 2023, the European Commission issued the European Sustainability Reporting Standards (ESRS), providing granular ESG disclosure requirements (European Commission, 2023b). In parallel, the International Sustainability Standards Board (ISSB) integrated the work of the IIRC, SASB, and TCFD and released two cornerstone standards: IFRS S1 on general sustainability-related financial disclosures and IFRS S2 on climate-related disclosures (IFRS, 2023a; IFRS, 2023b). Post-2020 standards steer firms toward global alignment, greater transparency about sustainability performance, and clear reporting on how climate change creates opportunities and risks for financial health. Together with national laws, these international frameworks spell out what is needed to produce high-quality sustainability reports and make visible how those requirements have developed over time.

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2.2. Quality of the Sustainability Reporting

Sustainability reporting has become a central focus for both researchers and practitioners, driven by intensifying stakeholder demands for transparent disclosure of environmental, social, and governance (ESG) information (Hahn & Kühnen, 2013; Junior, Best, & Cotter, 2014). A core theme in the sustainability reporting literature is the uneven quality of these disclosures (Dando & Swift, 2003; Clarkson, Li, Richardson, & Vasvari, 2008; Michelon, & Patten, 2012; Boiral, 2013). The main reason for this is that there is no definitive and universally accepted explanation of what sustainability reporting is and what its dimensions are.

Rezaee and Tuo (2019) conceptualized Quality Sustainability Reporting as the degree to which firms apply and utilize the GRI framework in presenting sustainability information. In contrast, Al-Shaer and Zaman (2016, 2018) treated QSR purely as the presence or absence of external assurance on the sustainability report.

Gao et al. (2016) evaluated Quality Sustainability Reporting (QSR) based on a government-prescribed framework, considering five key dimensions: relevance, clarity, reliability, responsiveness, and coherence (p. 294). Some researchers describe QSR as multidimensional. Helfaya et al. (2019) assess it through three pillars: content, credibility, and communication (p. 163). Michelon et al. (2015) set out four dimensions: relative quantity, density, accuracy, and managerial orientation. In their view, relevance requires disclosures that address stakeholder priorities while aligning with the firm's strategic context; this makes a rigorous materiality process indispensable (p. 10). Taken together, these studies treat materiality and assurance as foundational aspects of QSR (Khan et al., 2021).

Through materiality assessment, firms determine which ESG topics matter most for the business and its stakeholders. Because this decision sets the report's priorities, it becomes a primary yardstick for how users judge reporting quality (Hahn & Kühnen, 2013).

Credibility in sustainability disclosure also depends on assurance. When independent third-party specialists verify the accuracy of reported ESG information, external assurance increases the reliability of what is presented (Simnett, Vanstraelen, & Chua, 2009; Manetti & Toccafondi, 2012). Its contribution is greatest when assurance providers examine both the dependability and the material relevance of the information in depth (O'Dwyer, 2011; O'Dwyer, Owen, & Unerman, 2011).

2.3. Assurance and Materiality as QSR Dimensions

In sustainability reporting, information is deemed material if it can influence how stakeholders judge an organization's positive or negative contributions to broader aims such as the Sustainable Development Goals and if it can affect capital

providers' assessments of the enterprise's capacity to sustain long term value for the company and for society (Adams et al., 2020; Jørgensen et al., 2022). Unlike financial reporting, which applies materiality thresholds set by auditing standards, nonfinancial reporting largely leaves materiality judgments to management (Eccles & Krzus, 2014).

Research spans how firms structure sustainability reports, deploy assurance mechanisms (Amini et al., 2018; Eccles et al., 2012), and how assurance affects overall reporting quality (Boiral et al., 2019a; Boiral et al., 2020; Cohen & Simnett, 2015). The evidence indicates that assurance engagements raise the credibility, completeness, and reliability of sustainability disclosures (Dhaliwal et al., 2012; Casey & Grenier, 2015; Cuadrado-Ballesteros et al., 2017; Gillet-Monjarret, 2018; Ruiz-Barbadillo & Martínez-Ferrero, 2022). At the same time, in the absence of strong standardization, non financial reporting can unintentionally enable greenwashing (Lyon & Maxwell, 2011; Mahoney et al., 2013; Khan et al., 2021; Garst et al., 2022).

Scholarship on materiality in sustainability reporting centers on how firms design and defend their methods for selecting material topics (Calabrese et al., 2015; Canning et al., 2019; Hsu et al., 2013). A separate line of work emphasizes sector-dependent priorities that shape what rises to the top of the agenda (Karagiannis et al., 2022; Jayarathna, 2022) and examines how material topics steer corporate strategy and goal setting (Khan et al., 2016; Edgley, 2024). Another consistent finding is the decisive role of stakeholder engagement, which influences which issues are judged material and helps lift overall reporting quality (Fasan & Mio, 2017; Ngu & Amran, 2018; Bepari & Mollik, 2016; Torelli et al., 2020).

Despite a growing body of cross-industry research, the container shipping sector remains underexamined, especially with respect to the quality of environmental sustainability disclosures evaluated through materiality and assurance. This study addresses that gap by assessing Quality Sustainability Reporting in container shipping, concentrating on how environmental topics are reported and the extent to which materiality and external assurance underpin those disclosures.

By assessing QSR through environmental materiality, this study fills a gap by identifying the environmental topics that are material to container shipping and by describing the assurance practices applied to those topics. In addition, by evaluating the quality of assurance over sustainability disclosures, the study offers an original contribution to the literature on reporting reliability and argues for more systematic and wider use of assurance to improve QSR.

IJCEAS

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3. Data of the Research

This study draws on sustainability reports from the world's top ten container shipping companies (as designated by Alphaliner) over 2018–2022. The publication of Task Force on Climate-related Financial Disclosures (TCFD) recommendations in 2017 had notable implications for such companies (TCFD, 2018). Consequently, 47 reports were analyzed, of which 32 included external assurance and 15 did not. Table I illustrates which sustainability standards these container shipping firms used; the Global Reporting Initiative (GRI) emerged as the most prevalent.

Given in Table 1. that GRI Standards are the most widely adopted in this set, GRI served as the primary reference for evaluating the materiality and assurance dimensions of QSR in these sustainability reports. The quality of sustainability reporting is influenced by the materiality judgments conducted by companies, which are developed based on their analyses and consultations with stakeholders. Farooq et al. (2021) developed a scoring scheme anchored in how firms disclose their material issues, and then applied it to a systematic content analysis of the sampled companies' sustainability reports.

Table 1. Sustainability Reports prepared by Standards

Reports prepared by Standards	2018	2019	2020	2021	2022
MSC	GRI Standards	GRI Standards	GRI Standards	GRI Standards	GRI Standards
Maersk	ESG frameworks, including TCFD, SASB, GRI	ESG frameworks, including TCFD, SASB, GRI	ESG frameworks, including TCFD, SASB, GRI	ESG frameworks, including TCFD, SASB, GRI	ESG frameworks, including TCFD, SASB, GRI
CMA CGM	ESG, GRI, French Law, European Union's Non-Financial Reporting Directive	ESG, GRI, French Law, European Union's Non-Financial Reporting Directive	ESG, GRI, French Law, European Union's Non-Financial Reporting Directive	ESG, GRI, French Law, European Union's Non-Financial Reporting Directive	ESG, GRI, French Law, European Union's Non-Financial Reporting Directive
Cosco Shipping Lines	Not Published	Not Published	GRI Standards	GRI Standards	GRI Standards
Hapag Lloyd	GRI Standards	GRI Standards	GRI Standards	GRI Standards	GRI Standards
One Ocean Network Express	GRI Standards	GRI Standards	GRI Standards	GRI Standards	GRI Standards
Evergreen	GRI Standards	GRI Standards	GRI Standards	GRI Standards	GRI Standards

HMM Co Ltd	Not Published	GRI Standards	GRI Standards	GRI Standards	GRI Standards
Yang Ming	GRI Standards	GRI Standards	GRI Standards	GRI Standards	GRI Standards
Zim Lines	GRI Standards	GRI Standards	GRI Standards	GRI Standards	GRI Standards

Source: Authors' owns work

However, it was observed that container shipping companies have only identified material topics without systematically structuring the content of their sustainability reports or implementing assurance processes based on these assessments. As a result, the lack of a structured approach weakens the overall quality and comparability of sustainability reporting in the sector.

This significant gap points that how independent assurance and standardized materiality frameworks contribute to the overall quality of sustainability reporting. Without such mechanisms, sustainability disclosures may remain fragmented, inconsistent, and less reliable for stakeholders.

4. Methodology

This research applies content analysis to examine the sustainability reports of these major container shipping companies. Content analysis enables systematic evaluation of textual data to identify key themes or concepts (Krippendorff, 1989). The content analysis method has been utilized by others to analyze quality of the corporate sustainability reports (e.g., Landrum et al., 2018; Amini et al., 2018; Jayarathna et al., 2022; Karagiannis et al., 2022). Moreover, various approaches to content analysis exist. In conceptual content analysis, specific concepts are identified for examination, and their frequency and occurrence within the selected text are systematically measured and recorded (Jose & Lee, 2007). Conceptual content analysis was employed in this study to analyze the content of the sustainability reports of the container shipping companies so that quality of environmental disclosures could be determined on the basis of materiality and assurance.

Although GRI was selected for the materiality and assurance dimensions of the QSR, GRI does not provide a standard specifically designed for the container shipping industry. GRI standards are categorized into three groups: Universal Standards, Sector Standards, and Topic Standards. Relevant Topic Standards from GRI's environmental indicators are selected based on their applicability to the container shipping sector, and the information required by these Topic Standards is deemed material (GRI, 2024b).

Seven environmental Topic Standards were initially considered (GRI 301, 302, 303, 304, 305, 306, 308). GRI 301 (materials) and GRI 308 (supplier environmental assessment) were excluded based on their limited direct relevance to

container shipping's core operations, leaving GRI 302 (Energy), 303 (Water and Effluents), 304 (Biodiversity), 305 (Emissions), and 306 (Waste).

A scoring framework has been developed based on the remaining Topic Standards disclosure requirements to evaluate QSR based on materiality and assurance. A single page is considered as containing 25 lines. In this context, each page dedicated to a topical standard is allocated one point, while pages containing fewer than one full page are assigned 0.04 points per line (i.e., 1/25). The line-based scoring procedure was chosen because it makes it possible to see which topics occupy more space in the sustainability reports. The line-based score is regarded as a simple proxy for the quality of reporting in terms of coverage and completeness: the more space a company devotes to a topic, the more fully it is assumed to explain its policies, actions and performance in that area. Information that occupies less than one line is excluded from scoring. Tables and figures are incorporated into the calculation, with 0.04 points awarded for each. Based on this information, this study seeks to evaluate the quality of sustainability reporting on environmental issues by employing a scoring framework based on materiality and assurance criteria. The evaluation is conducted through a systematic analysis of the number of pages dedicated to these topics within corporate sustainability reports. This scoring method, based on the number of pages allocated, will provide a more accurate understanding of which topics receive greater emphasis in the reports. The line-based scoring procedure was chosen because it makes it possible to see which topics occupy more space in the sustainability reports. Assuming 25 lines per page and assigning 1 point per page (0.04 per line) provides a straightforward indicator of the relative emphasis placed on different environmental issues, which can be compared across companies and reporting years.

5. Results

In Table 2, the average number of pages in the reports, the average number of pages dedicated to environmental topics, the ratio between these two metrics, and the proportion of pages covering material environmental topics relative to the total number of pages allocated to environmental disclosures were calculated.

An analysis of the 47 reports across different years is presented in Table 2. On average, container shipping companies dedicate 2% of their sustainability reports to fulfilling the requirements of GRI 302: Energy 2016, 1% to meeting the requirements of GRI 303: Water and Effluents 2018, 1% to complying with GRI 304: Biodiversity 2016, 5% to addressing GRI 305: Emissions 2016, and 2% to covering GRI 306: Waste 2020. In total, environmental material topics constitute only 12.7% of sustainability reports, indicating a limited depth of environmental disclosure relative to broader sustainability reporting. Furthermore, it was found that container shipping companies allocate approximately 15% of their reports to environmental topics.

Table 2. Average Score by Categories

	GRI 302: Energy 2016	GRI 303: Water and Effluents 2018	GRI 304: Biodiversity 2016	GRI 305: Emissions 2016	GRI 306 : Waste 2020	Percentage of Material Environment Information	Total Pages	Environment Section	Percentage of Environment Section
2018	0.024	0.015	0.015	0.047	0.024	0.125	65.60	11.100	0.125
2019	0.025	0.008	0.016	0.044	0.017	0.111	89.20	13.000	0.124
2020	0.024	0.012	0.021	0.049	0.017	0.123	95.30	14.800	0.145
2021	0.027	0.010	0.017	0.055	0.023	0.132	101.7	19.100	0.187
2022	0.021	0.012	0.024	0.064	0.023	0.144	111.5	22.100	0.194
Mean	0.024	0.011	0.019	0.052	0.021	0.127	92.66	16.020	0.155

Among the 47 sustainability reports analyzed, 32 have undergone assurance processes. The assurance providers for these reports, along with the corresponding years in which the assurance was conducted, are detailed in Table 3.

The values assigned by companies concerning assurance over the years are presented. The annual average values were calculated, as shown in Table 4, by averaging the values assigned across the respective years. For assurance evaluation, each page was assumed to contain 25 lines, with 0.04 points assigned per assured line and one point allocated per fully assured page. Additionally, based on the number of pages, the following metrics were calculated: ratio of the material environmental information assured with material environmental information, percentage of environmental information assured, and the proportion of the overall report that has undergone assurance in percentage terms.

The resulting figures for each topic standard were aggregated to represent the proportion of material environmental information that has been assured. The findings reveal that the assured material environmental issues correspond to 32.4% of the material environmental information. Within this proportion, 11% comes from GRI 302: Energy 2016, 7% comes from GRI 303: Water and Effluents 2018, 7.1% comes from GRI 304: Biodiversity 2016, 16% comes from GRI 305: Emissions 2016, and 7.2% comes from GRI 306: Waste 2020.

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Table 3. Assurers of the Sustainability Reports

Assurance Companies	2018	2019	2020	2021	2022
MSC	No Assurance	No Assurance	No Assurance	No Assurance	Ernst&Young
Maersk	PwC	PwC	PwC	PwC	PwC
CMA CGM	KPMG S.A.	KPMG S.A.	KPMG S.A	KPMG S.A.	KPMG S.A.
COSCO SHIPPING LINES	No Report Published	No Report Published	CECEP (HK) Advisory Company Limited ("CECEPAC (HK)"	CECEP (HK) Advisory Company Limited ("CECEPAC (HK)	CECEP (HK) Advisory Company Limited ("CECEPAC (HK)"
Hapag Lloyd	PwC	PwC	PwC	PwC	KPMG S.A.
One Ocean Network Express	No Assurance	No Assurance	No Assurance	No Assurance	PwC
Evergreen	Deloitte	Deloitte	Deloitte	Deloitte	PwC
HMM Co Ltd	No Report Published	Korea Management Registrar	Lloyd's Register Quality Assurance Limited (LR)	Korea Management Registrar (KMR)	The Korean Standards Association ("KSA")
Yang Ming	DNV GL Business Assurance Co Ltd.	DNV GL Business Assurance Taiwan	DNV GL Business Assurance Taiwan	DNV GL Business Assurance Taiwan	DNV GL Business Assurance Taiwan
Zim Lines	No Assurance	No Assurance	No Assurance	No Assurance	No Assurance

Source: Authors' owns work

Table 4. Assurance of Sustainability Information

	GRI 302: Energy 2016	GRI 303: Water and Effluents 2018	GRI 304: Biodiversity 2016	GRI 305: Emissions 2016	GRI 306: Waste 2020	Material Environment Information Assured / Material Environment Information	Percentage of Environmental Information Assured	Total Assurance Ratio
2018	0.137	0.134	0.110	0.173	0.114	0.269	0.114	0.156
2019	0.174	0.126	0.117	0.215	0.123	0.354	0.170	0.181
2020	0.086	0.025	0.039	0.095	0.032	0.279	0.207	0.108
2021	0.084	0.020	0.046	0.164	0.029	0.342	0.240	0.114
2022	0.077	0.045	0.041	0.151	0.061	0.375	0.289	0.144
Average of the Years	0.111	0.070	0.071	0.160	0.072	0.324	0.204	0.141

Source: Authors' own work

The total number of assured pages related to environmental material topics was divided by the total number of pages allocated to environmental issues. Overall, 20.4% of the environmental sections of the reports are assured. Furthermore, other topics within the reports are also assured, in addition to environmental issues. The total assurance rate was calculated by dividing the number of assured pages by the total number of pages in the reports, resulting in 14.1% of the reports having undergone assurance.

The analysis reveals that container shipping companies published a total of 47 sustainability reports between 2018 and 2022, of which 32 included assurances. Utilizing a detailed scoring framework based on GRI standards, the study evaluates the sustainability reporting quality based on materiality and assurance indicators. Despite 12.7% of total report content being allocated to environmental material issues, only 32.4% of this information was subject to assurance, raising concerns about the reliability of environmental disclosures. Furthermore, while companies, on average, dedicated 15.5% of report content to environmental topics, only 20.4% of that content received assurance, highlighting inconsistencies in assurance practices. The analysis also indicates that only 14.1% of total report content was assured, emphasizing the need for greater transparency, standardization, and external validation to enhance QSR.

Moreover, the most frequently addressed environmental topics in the reports, in descending order, are emissions, energy, waste, biodiversity, and water and effluents. However, variations in disclosure depth and assurance levels across these topics suggest a fragmented approach to environmental reporting, further impacting the comparability and overall quality of sustainability disclosures within the industry. Strengthening assurance mechanisms and aligning reporting practices more closely with established GRI standards could significantly enhance the QSR and improve the credibility and decision-usefulness of sustainability reports for stakeholders.

6. Conclusion

This study offers a content analysis of sustainability reports from the world's leading container shipping firms to evaluate the Quality of Sustainability Reporting (QSR), focusing on how these reports disclose material environmental issues and employ external assurance. Sustainability reports represent a primary channel for communicating corporate environmental impacts and performance to stakeholders and investors; thus, their credibility and materiality are vital markers of high-quality disclosure. Yet, although such reports are commonly viewed as demonstrations of corporate responsibility, the present findings reveal notable inconsistencies in how environmental topics are disclosed and assured, raising questions about the reliability and transparency of sustainability information.

Despite growing emphasis on environmental disclosures and material topics, independent assurance for these disclosures remains inadequate. Also,

among the sustainability reports that obtained external assurance, only two disclosed the use of reasonable assurance, while the remaining assured reports were conducted on a limited assurance basis. This gap may erode stakeholder and investor confidence in sustainability reporting. Even though companies frequently highlight core environmental dimensions such as emissions, energy consumption, waste management, biodiversity, and water and effluents, the shortage of comprehensive assurance for these disclosures undermines their decision-usefulness. More robust assurance processes could significantly enhance the comparability, credibility, and overall quality of sustainability reporting in the container shipping domain.

The findings also reinforce an urgent need to strengthen assurance mechanisms, particularly in the areas that stakeholders deem essential to environmental sustainability. Nonetheless, the study faces several limitations, such as a relatively small sample of sustainability reports, certain assumptions informing the scoring methodology, subjective determinations of material environmental issues, and an exclusive focus on container shipping.

One limitation of this study is that it uses GRI environmental Topic Standards as a common list of relevant issues for the sector, without checking in detail whether each company itself marked these topics as material in its own materiality matrix. This means the results may not fully reflect firm-specific materiality judgments based on their own impact assessments and stakeholder input. Another limitation is that the scoring scheme assumes one page consists of 25 lines and assigns 1 point (0.04 per line), which is a practical simplification that may not fully reflect differences in quality across reports.

Future research could enhance the understanding and improvement of QSR by expanding the sample size, analyzing sustainability reports from multiple industries, and examining a broader range of environmental, social, and corporate governance (ESG) topics. Additionally, further studies could explore innovative assurance strategies that strengthen the credibility, consistency, and decision-usefulness of sustainability reports, ensuring that stakeholders receive more reliable and standardized sustainability disclosures across industries.

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