



Evaluating materiality disclosure in sustainability reports: A study of North American construction and engineering firms

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ABSTRACT

This research evaluates the sustainability reporting practices of 10 leading North American construction and engineering firms, focusing on adherence to the Sustainability Accounting Standards Board (SASB) Standards for the Engineering and Construction Services sector. The analysis covers five material topics: Ecological Impacts, Product Quality & Safety, Employee Health & Safety, Product Design & Lifecycle Management, and Business Ethics. Results reveal significant gaps in reporting, with most firms failing to meet full disclosure for SASB metrics. Ecological Impacts and Business Ethics are the weakest areas, with limited disclosures on environmental risks and anti-competitive practices. Employee Health & Safety shows moderate compliance, with few firms reporting key metrics like Total Recordable Incident Rates (TRIR). The study highlights the urgent need for enhanced transparency, standardized reporting, and robust governance frameworks. Improving alignment with SASB standards will foster accountability, strengthen stakeholder trust, and advance sustainability within the sector.

Keywords

- Sustainability reporting
- Materiality disclosure
- Construction
- Engineering
- Sustainability accounting standards board

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1. Introduction

Sustainability reporting (SR) is a critical process for businesses to communicate their environmental, social, and corporate governance (ESG) performance to stakeholders such as employees, investors, customers, and regulatory bodies [1]. It allows companies to demonstrate their commitment to sustainability while enabling the systematic evaluation of progress toward achieving their environmental and social goals. By tracking metrics such as carbon emissions, energy consumption, water usage, workforce diversity, and community engagement, businesses provide stakeholders with a transparent account of their efforts to reduce environmental impacts and address social issues. This process not only fosters accountability but also supports long-term value creation by aligning corporate actions with stakeholder expectations.

Central to SR is the concept of materiality, which involves identifying and disclosing ESG issues most relevant to a company's performance and societal impact [2]. Materiality assessments help organizations focus on significant topics while avoiding irrelevant or trivial information.

Frameworks like the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB) provide structured guidelines to enhance the reliability, comparability, and transparency of these reports within a specific industry. SASB's Sustainable Industry Classification System (SICS®) is particularly valuable for its sector-specific standards, grouping companies based on sustainability risks and material topics rather than traditional industry classifications. By tailoring reporting requirements to sectoral impacts, SASB ensures that companies address

material ESG issues with precision, offering investors and stakeholders a consistent basis for evaluating sustainability performance and impact. For this study, SASB's standards for Engineering and Construction Services are utilized, given their relevance and comprehensive approach, while GRI's standards remain under development for this sector. This alignment with SASB's framework ensures a focused, industry-specific approach to sustainability disclosure.

2. Background

2.1. The construction and engineering industry

The construction and engineering industry necessitates robust sustainability analysis due to its significant environmental, social, and economic impacts. Responsible for 37% of global carbon emissions, this sector plays a pivotal role in infrastructure development and urbanization, directly influencing global sustainability and climate goals [3,4].

This sector bears a significant social responsibility to produce detailed ESG reports, which are critical for promoting sustainability initiatives, ensuring corporate accountability, and influencing investor decision-making. Robust ESG reporting can help industries reduce their ecological footprints, align with global climate goals, and demonstrate their commitment to resilience and accountability in an increasingly unpredictable climate future. The current state of SR in the construction and engineering industry reflects growing efforts to disclose both environmental and social impacts, in addition to financial



performance. SR in the construction sector varies widely in quality and content [5]. This variation stems from factors such as differing motivations for reporting, ranging from moral considerations to strategic advantages, and the lack of a standardized approach for reporting non-financial aspects. While frameworks like SASB and GRI provide guidelines for reporting, companies still lack a consistent method for integrating sustainability metrics into corporate strategies [5].

Despite some progress in recent years, there remains a significant gap in literature and practice when it comes to evaluating the quality of disclosures and assessing how these reports are linked to long-term sustainability goals within the construction and engineering industry [5].

One critical area for further exploration is how materiality is disclosed within SR, particularly in the context of North American construction and engineering companies. A study on evaluating materiality disclosure compliance in SR within the North American construction and engineering sector could fill several gaps in current research. First, such research would provide valuable insights into whether companies are accurately identifying and reporting on the issues that matter the most to their business and stakeholders.

Secondly, it could highlight inconsistencies or shortcomings in current reporting practices. Lastly, such analysis can contribute to understanding how materiality disclosures impact corporate sustainability management. Given the complexity of the construction industry’s stakeholder structure, ranging from contractors and government agencies to architects and suppliers, understanding how companies disclose and communicate material topics is essential for reducing information asymmetries and meeting stakeholder needs.

2.2. Key industry stakeholders

The construction and engineering companies analyzed in this study engage with stakeholders through their SR in three primary ways: (1) discussing social initiatives tailored to stakeholder groups such as employees and customers, (2) addressing key ESG concerns, (3) and presenting its ESG advancements for this paper, an initial list of 12 key construction stakeholder groups was derived from a recent study [6]. However, since the study focused on construction projects rather than companies in their entirety, the list was further refined and condensed into eight key stakeholder groups based on insights from the conducted SR analysis done for this paper (Table 1).

Table 1: Sustainability report stakeholder analysis in the construction and engineering industry [6].

Stakeholder group	Relationship description	Level of overall influence	SASB materiality category stakeholder priority	Ownership structure applicability
Customers	Customers (Governments + Corporate Clients) rely on construction companies to deliver projects that meet their requirements, timelines, and quality standards, while construction companies depend on customers for resources and approvals.	High	Product quality and safety	Private & public
Industry regulators and associations	Regulators and associations establish industry standards and guidelines. Construction companies adhere to these requirements to maintain industry reputation, operational capacity, and safety standards.	High	All material topics	Private & public
Investors & shareholders	Investors provide capital support, expecting transparency, profitability, and a return on their investment from the invested companies.	High	Business ethics	Private & public
Board of directors	The Board of Directors provides governance, oversight, and strategic direction focused on supporting the company’s long-term growth and compliance with legal and ethical standards.	High	Business ethics	Private & public
Employees	Employees provide their skills and labor to complete projects safely and efficiently, while companies offer compensation, resources, and a safe working environment to support their workforce.	Medium	Employee health and safety	Private & public
Competitors/Peers	The relationship between construction companies is characterized by industry benchmarking and innovation, as they use industry standards and each other’s performance to drive improvements and advancements.	Medium	Ecological impacts, product design & lifecycle management	Private & public
Suppliers	Suppliers provide the essential materials and resources to construction and engineering companies. Said companies are reliant on their timely delivery to maintain their project timelines.	Low	Product design & lifecycle management, product quality	Private & public
Local communities	Communities possess some activist power when their interests are not aligned with projects; however, they are not inherently detrimental to the companies and can become valuable partners if their	Low	Ecological impacts, product quality & safety	Private & public

concerns are addressed and mutual benefits are established.

Understanding the reciprocal relationship between these stakeholders and SRs is important, as stakeholders influence company disclosures, inform corporate decision-making, and help organizations achieve sustainability goals and metrics. Targeted sections in SRs help cater to specific stakeholder groups, enabling companies to evaluate performance relative to their industry peers.

Industry benchmarking within these reports allows stakeholders to assess whether a company is leading or lagging in sustainability practices, highlighting competitive strengths or areas for improvement. For instance, outperforming competitors in reducing carbon emissions or improving labor conditions may position a company as a sustainability leader and can enhance its reputation and market value.

Conversely, lagging behind peers can signal a need for strategic adjustments or increased investment in sustainability initiatives. From an investor’s perspective, these reports offer critical insights into how a company manages ESG risks and opportunities, influencing perceptions of long-term value and risk [7].

Transparency in reporting also helps investors and regulatory bodies determine whether companies meet sustainability criteria and align with industry standards. Effective stakeholder engagement through SR builds trust, aligns corporate actions with stakeholder expectations, and ultimately supports the achievement of sustainability objectives.

Stakeholder insights inform SASB’s identification of key material topics for the construction and engineering industry, which will be explored further in the following section.

2.3. Materiality in the construction and engineering industry

Materiality in the construction and engineering sector involves identifying ESG issues that most significantly impact the industry’s ability to create long-term value. Given the sector’s vast scale and diverse activities, material ESG considerations arise from its operations’ direct and indirect impacts on global sustainability goals.

From designing critical infrastructure to constructing commercial and industrial facilities, the sector influences energy consumption, resource use, and emissions across the entire lifecycle of its projects. Its ability to address these impacts is essential for meeting global challenges, such as climate change, resource scarcity, and urban resilience [8]. Furthermore, as the sector serves public and private stakeholders, aligning its practices with material ESG priorities is critical for meeting regulatory expectations and fostering sustainable growth. SASB Standards identified for the construction and engineering industry through SICS® include five sustainability issue categories, which include Ecological Impacts, Product Quality & Safety, Employee Health & Safety, Product Design & Lifecycle Management, and Business Ethics (Table 2).

Table 2: Sustainability disclosure topics and metrics [8].

Issue category	Disclosure topic	metric	Category	Unit of measure	Code
Ecological impacts	Environmental impacts of project development	Number of incidents of non-compliance with environmental permits, standards and regulations	Quantitative	Number (#)	IF-EN-160a.1
		Discussion of processes to assess and manage environmental risks associated with project design, siting and construction	Discussion and Analysis	N/A	IF-EN-160a.2
Product quality & safety	Structural integrity & safety	Amount of defect- and safety-related rework costs	Quantitative	USD (\$)	IF-EN-250a.1
		The total amount of monetary losses because of legal proceedings associated with defect- and safety-related incidents	Quantitative	USD (\$)	IF-EN-250a.2
Employee health & safety	Workforce health & safety	(1) Total recordable incident rate (TRIR) and (2) fatality rate for (a) Direct employees and (b) Contract employees	Quantitative	Rate (%)	IF-EN-320a.1
Product design & lifecycle management	Lifecycle impacts of buildings & infrastructure	Number of (1) Commissioned projects certified to a third-party multi-attribute sustainability standard and (2) Active projects seeking such certification	Quantitative	Number (#)	IF-EN-410a.1
		Discussion of the process to incorporate operational-phase energy and water efficiency considerations into project planning and design	Discussion and Analysis	N/A	IF-EN-410a.2
Product design & lifecycle management	Climate impacts of business mix	Amount of backlog for (1) Hydrocarbon-related projects and (2) Renewable energy projects	Quantitative	USD (\$)	IF-EN-410b.1
		amount of backlog cancellations associated with hydrocarbon-related projects	Quantitative	USD (\$)	IF-EN-410b.2

		Amount of backlog for non-energy projects associated with climate change mitigation	Quantitative	USD (\$)	IF-EN-410b.3
Business ethics	Business ethics	(1) Number of active projects and (2) Backlog in countries that have the 20 lowest rankings in transparency international's corruption perception index	Quantitative	Number (#), USD (\$)	IF-EN-510a.1
		the total amount of monetary losses as a result of legal proceedings associated with charges of (1) Bribery or corruption and (2) Anti-competitive practices	Quantitative	USD (\$)	IF-EN-510a.2
		Description of policies and practices for prevention of (1) Bribery and corruption, and (2) Anti-competitive behavior in the project bidding processes	Discussion and Analysis	n/a	IF-EN-510a.3

3. Method

3.1. Selection of companies

The companies selected for this research are included on the World Benchmarking Alliance (WBA)'s SDG2000 list, which identifies the 2,000 most influential companies globally that have the potential to significantly impact the achievement of the United Nations Sustainable Development Goals (SDGs) [9].

These companies are benchmarked by the WBA based on their performance in social, environmental, and governance domains, positioning them as ideal candidates for a sustainability analysis. This paper will focus on the top 12 construction and engineering companies in North America (Table 3).

However, only 10 reports will be analyzed due to SR availability. By concentrating on these firms, the study centers on keystone companies that can drive systemic change in the construction & engineering industry.

Table 3: Top 12 construction and engineering companies in North America [9].

Company	Primary Activities	Location of Incorporation	Ownership Structure	Sustainability Report
AECOM	AECOM is involved in creating, constructing, and maintaining key infrastructure for large organizations.	Delaware, USA	Public	✓
Bechtel	Bechtel provides engineering, construction, and project management services to a wide range of clients.	Virginia, USA	Private	✓
Burns & McDonnell	Burns & McDonnell provides engineering, design, and consulting services in the construction industry.	Missouri, USA	Private	✓
EMCOR	EMCOR is involved in the construction of key mechanical and electrical infrastructure alongside the energy industry.	Delaware, USA	Public	✓
Fluor	Fluor provides engineering, procurement, and construction services focusing on energy solutions.	Delaware, USA	Public	✓
HDR	HDR provides architecture, engineering, and construction services. Globally leader in design services.	Nebraska, USA	Private	✓
HOK Group	HOK is a design, architecture, and engineering firm leading in community-focused landscape and interior design.	Missouri, USA	Private	✓
Jacobs	Jacobs provides engineering and consulting services - specifically focused on technology-centric solutions.	Delaware, USA	Public	✓
Quanta Services	Quanta Services is involved in the planning, design, and installation sectors, primarily with expertise in power, oil and gas, communication, and energy industries.	Delaware, USA	Public	✓
Stantec	Stantec is a global design and engineering firm that provides consulting services focusing on sustainable infrastructure and community development projects.	Edmonton, CA	Public	✓
SWA Group	SWA Group is an environmental engineering and design firm - with a large focus on architecture and urban design.	California, USA	Private	✗
Whiting-Turner Contracting	Whiting-Turner Contracting provides construction and project management types to a variety of different organizations.	Maryland, USA	Private	✗

3.2. Selection of sustainability framework

The 'Engineering and Construction Services Standard' document by SASB outlines sustainability accounting standards specific to the engineering and construction industry [8].

It provides guidance on disclosing sustainability-related risks and opportunities affecting financial performance tailored to industry activities. In this research paper, the methodology involves utilizing the sustainability disclosure topics and metrics outlined in the SASB Engineering and Construction Services Standard as a framework for

evaluating industry practices. The document provides industry-specific guidance for assessing ESG performance, including five key disclosure topics, as discussed in Section 3.1. Each metric will be analyzed to evaluate its relevance and application in real-world engineering and construction projects, with a focus on its ability to capture meaningful sustainability performance data. This approach enables the identification of best practices and potential gaps in disclosure, contributing to an understanding of how these standards can drive transparency and accountability within the industry.

3.3. Research Design

A systematic analysis of SRs was conducted to evaluate disclosure practices across all five topics. This method followed a two-step process designed to ensure comprehensive and reliable assessments. First, an initial review of each SR was undertaken to identify any relevant disclosures, strategies, and commitments related to the materiality topics under investigation. While evaluating each SR,

targeted keyword searches were conducted to capture specific disclosures and data points that might be overlooked during the general review (Table 2). This approach ensured that even subtle or indirect references to materiality topics were identified and analyzed.

A scoring framework was applied consistently across all companies to assess the quality and completeness of disclosures (Table 4). Each company received a score between 0 and 2 based on the level of disclosure. A score of "0" indicated no disclosure on the topic (<10%), "1" was assigned for partial disclosures that did not fully meet SASB or equivalent standards (10-80%), and "2" was awarded for complete and accurate disclosures aligned with the required metrics (>80%).

This scoring applied to both quantitative and qualitative disclosures, with full disclosure requiring detailed and specific reporting on both elements. This structured, iterative process ensured that all relevant information was captured and assessed objectively for each topic, enabling a comprehensive evaluation of SR practices.

Table 4: Top 12 construction and engineering companies in North America [9].

Company	Ecological impact	Product quality & safety	Employee health & safety	Product design & lifecycle management	Business ethics	Total score
AECOM	1	1	1	1	1	5
Bechtel	0	0	1	0	0	1
Burns & McDonnell	0	0	1	1	0	2
EMCOR	1	2	2	2	1	8
Fluor	1	0	1	0	0	2
HDR	0	0	1	0	0	1
HOK Group	0	0	0	1	0	1
Jacobs	1	0	2	1	0	4
Quanta Services	1	1	1	1	1	5
Stantec	2	1	1	2	1	7
SWA Group	N/A	N/A	N/A	N/A	N/A	N/A
Whiting-Turner Contracting	N/A	N/A	N/A	N/A	N/A	N/A

0	Not Disclosed (<10%)
1	Partially Disclosed (10-80%)
2	Disclosed (>80%)
N/A	Not Assessed

4. Results

4.1. Ecological impact

Infrastructure construction drives economic and social development but often poses environmental risks, such as ecosystem disruption, resource depletion, pollution, and waste generation. Activities like land clearing and excavation can exacerbate these impacts, leading to regulatory fines, project delays, or even cancellations due to community opposition [8].

Conducting environmental impact assessments before and during project development helps identify and mitigate potential risks, reduce costs, and protect the company's reputation. Proactive environmental management

not only minimizes financial and regulatory risks but also enhances competitiveness in securing future contracts.

- IF-EN-160a.1. This metric focuses on the number of incidents of non-compliance with environmental permits, standards, and regulations. It requires companies to disclose any instances where they failed to comply with environmental laws during project development [8]. There is a significant variation in reporting practices within the leading North American construction and engineering firms concerning incidents of non-disclosure with environmental regulations. AECOM stands out for its detailed and transparent approach, providing key quantitative data in an annex to its report. This data is compiled per SASB and the Task Force Climate Disclosures (TCFD)

standards, offering insights into environmental disclosure [10]. Others, like Stantec, report having no material fines or sanctions for non-disclosure during the reporting period [11].

However, many companies, including Bechtel and Burns & McDonnell, lack any identifiable disclosure on this metric. This inconsistency in reporting poses challenges to transparency and comparability across companies. While some companies demonstrate a commitment to disclosing environmental compliance incidents, the lack of standardized quantitative data makes it difficult to assess the true extent of environmental performance across the industry.

- IF-EN-160a.2. This metric requires companies to discuss their processes for assessing and managing environmental risks associated with project design, siting, and construction. It involves detailing the strategies and measures in place to identify, evaluate, and mitigate environmental risks throughout the project lifecycle [8]. Most companies demonstrate awareness of environmental risk management, with common practices including formalized frameworks, project-level assessments, and data-driven solutions. Firms such as AECOM, Fluor, and Jacobs employ structured systems like enterprise risk management (ERM) frameworks, which include dedicated risk committees for oversight.

Project-level assessments are emphasized by Fluor and Quanta Services, allowing tailored strategies for high-risk projects [12,13]. Data-driven tools, such as Fluor's Unison™ EPC, further enhance predictive capabilities and mitigation strategies [13]. Additionally, systems like Stantec's ISO 14001-certified Environmental Management System exemplify best practices for consistent environmental performance [11].

EMCOR conducts various environmental inspections and audits as part of its risk management process, including independent environmental audits, fleet management program inspections, and general environmental health and safety inspections. Additionally, EMCOR also has a carbon tracking program that monitors its energy and fuel use [14].

These diverse approaches highlight the growing commitment within the construction and engineering industry to proactively address environmental risks and minimize their impact. However, the inconsistency in reporting practices and lack of standardized quantitative data suggest that many companies must do more to demonstrate accountability and transparency.

Notably, a distinction was observed between the public and private companies that were assessed. All private companies failed to disclose their ecological impact, resulting in Material Disclosure Measurement Scores of "0" (Table 4). This suggests a systemic gap in transparency among privately held firms that must be addressed. Strengthening these efforts is essential

not only to meet regulatory and stakeholder expectations but also to drive genuine progress toward sustainability in the sector.

4.2. Product quality and safety

Engineering and construction companies have a professional duty to ensure the safety and integrity of their projects. Design errors or poor construction quality can lead to injuries, property damage, legal liabilities, and reputational harm. Additionally, with increasing climate risks, entities must account for climate change impacts on structural integrity and public safety.

Simply meeting minimum codes may not suffice as climate-related events become more frequent and severe [8]. Proactively exceeding quality standards and implementing controls to address design flaws and climate risks can help reduce financial liabilities, improve safety, and safeguard reputation and growth opportunities.

- IF-EN-250a.1. This metric requires construction and engineering companies to report rework costs, which SASB defines as "activities in the field that have to be done more than once or activities that require the removal of previously installed work" [8]. Of the companies evaluated, one fully disclosed the required information, three were assessed as partially disclosed, and six did not disclose any data. The three partially disclosed companies failed to provide the numerical data necessary for full compliance.

Quanta Services indicated its interest in reporting on this metric by stating, "We are currently reviewing the feasibility of capturing and reporting on such data for future disclosures" [12]. Stantec described its internal claims process but did not separately capture costs for defect- or safety-related rework [11].

All three of these companies report against SASB standards, and while the metric was mentioned in their reports, they did not provide the required numerical data. This highlights the importance of increased accountability and public transparency in disclosing critical metrics, especially for companies reporting under the SASB framework.

Five of the six companies categorized as non-disclosure did not mention product safety, quality, or rework costs. Bechtel was the only non-disclosure company to reference "Quality and Compliance" in their performance and project quality; however, as they did not address structural integrity and safety, they were marked as non-disclosure.

Lastly, EMCOR was the only company to fully disclose the required quantitative measure, reporting its \$2.4 million invested in its defect and safety-related rework costs [14]. Through this, EMCOR demonstrates its leadership in its transparency practices and true disclosure compliance.

- IF-EN-250a.2. The second metric of structural integrity and safety focuses on the monetary loss incurred

as either a consequence of “legal proceedings associated with defect- and safety-related incidents and allegations” [8] and/or any “monetary liabilities to the opposing party” [8]. The analysis for this metric identified a nearly identical trend as the one illustrated above for IF-EN-250a.1. Three companies were recorded as partially disclosed, six as non-disclosed, and one as fully disclosed.

The three partially disclosing companies provided the same qualitative reasoning as the ones illustrated for the first metric, except for AECOM and Stantec. While both companies maintained their monetary losses as confidential, they provided a metric-specific reason as to why they decided to do so.

AECOM highlighted that due to the nature of the industry, they are involved in investigations, claims, and lawsuits; however, because there is some uncertainty of whether they or their “affiliates” are under investigation, gathering information to report might be a challenge. Furthermore, they restate that all material costs are reported to the SEC [10].

Stantec, on the other hand, discusses its successful “Risk Management Group,” stating that any legal proceedings they have been a part of have not exceeded their liability insurance and, therefore, do not act as a material cost to the company [11]. While they did not disclose the quantitative amount, their qualitative explanation allowed for some transparency.

The six non-disclosure companies did not have any quantitative or qualitative mention of legal proceedings due to defect- and safety-related incidents. As for the previous metric, EMCOR was the only company to disclose its monetary loss associated with defect-related incidents [14].

Overall, the observed lack of disclosure suggests that structural integrity and safety may not yet be recognized as critical enough by stakeholders to drive more comprehensive disclosures or the development of clearer guidelines and actionable steps for enhancing product quality and safety reporting.

A literature review conducted by Cortés et al. [15] found that sustainability disclosures are often motivated by “social/political motives,” with prioritized topics prominently reflected within sustainability reports. This disparity in perceived value is evident even within EMCOR, which, while receiving the highest disclosure score across both product quality and safety disclosure metrics, did not provide qualitative details about its re-work costs or specify initiatives aimed at improving structural integrity and product safety.

The potential for significant monetary loss from re-work costs, highlighted by a global study that indicated rework costs could account for more than 11% of total project costs [16] alongside the hazardous consequences of poor product quality and safety and the reputational risks associated with low structural

integrity, underscores the need for increased transparency and disclosure.

4.3. Employee health and safety

The construction and engineering industry involves significant manual labor, leading to high rates of fatalities and injuries compared to other sectors. Workers face risks from heavy machinery, falls, hazardous chemicals, and other dangers, with temporary workers particularly vulnerable due to lack of training.

Failing to ensure worker safety can result in fines, legal liabilities, project delays, and increased costs. Companies that prioritize health and safety training in addition to fostering a strong safety culture can reduce risks, improve profitability, and enhance their competitiveness in future project bids [8].

- IF-EN-320a.1. Upon quantitative analysis, all companies reported an employee Total Recordable Incident Rate (TRIR) measure. While all companies are compliant, only Jacobs reported separate TRIR measures for employees and contracted employees. Companies should strive to disclose one TRIR measure for employees and another measure for contracted employees for better transparency and information quality.

There were observed discrepancies between companies when reporting metrics associated with fatality rates. Only three companies, Burns & McDonnell, Jacobs, and Stantec, reported fatality rates for at least direct employees.

The remaining seven companies included in the analysis did not report or mention fatality metrics. Notably, Stantec’s employee health and safety data was collected from direct employees and excluded contract/subcontract employees, while all other company reports failed to mention fatality metrics.

Mention of fatality rates may have been disregarded reported as companies experienced no fatalities and, thus, neglected to explicitly report on this metric as their fatality rate equated zero.

Since SASB allows companies to disclose information at their prerogative, another reason for not reporting fatalities may be explained by companies choosing to withhold this metric due to the concern of negatively impacting a company’s public perception and/or negatively influencing stakeholders [17]. To avoid confusion, companies should ensure transparency and comparability by reporting fatality measures even if they are zero.

Overall, there are inconsistencies with employee health and safety disclosures where many companies did not meet the minimum reporting standards. It is important to note that in Table 4, Stantec (score of 1) disclosed lower than Jacobs and Burns & McDonnell (score of 2) as they only reported fatality rates for direct employees and excluded rates for contract employees.

Here, Stantec was adjusted to a score of 1 to curate a uniform score scale, but, notably, their quality of reporting was better than the remaining companies since the remaining companies neglected to report a fatality metric. Out of the 10 evaluated companies, only Jacobs and Burns & McDonnell fully disclosed with SASB. Additionally, it was observed that all companies reported several additional employee health and safety metrics outside of SASB, with Lost Workday Case Rate (LWCR), Lost-Time Injury Frequency Rates (LTIFR), and Days Away Restriction/Transfer Rate (DART) being the most popular.

4.4. Product design and lifecycle management

Buildings and infrastructure projects are major consumers of natural resources, using materials such as steel, cement, and glass during construction, and consuming significant quantities of energy and water during operations. This resource use can lead to direct and indirect greenhouse gas (GHG) emissions, water stress, and negative health impacts. As demand for sustainable construction grows, certification schemes evaluating energy and water efficiency, human health impacts, and sustainable materials are emerging [8].

Companies offering sustainability-focused design, construction, and consulting services can gain a competitive edge and capitalize on market growth. Climate regulations significantly affect the sector, with some construction projects contributing to GHG emissions and others, such as renewable energy or mass transit projects, mitigating them.

As environmental regulations intensify, assessing climate-related risks and opportunities in business plans can help investors understand the broader impact of climate change on companies' businesses.

- IF-EN-410a.1. For the metric IF-EN-410a.1., which evaluates projects certified to third-party multi-attribute sustainability standards, significant variability was observed in the disclosures provided by the analyzed companies. Some firms, such as AECOM, Quanta Services, and Jacobs, mentioned third-party involvement in certification processes but failed to provide specific quantitative data.

On the other hand, companies such as Fluor and HDR did not report any relevant data on certified projects, representing a clear gap in their SR practices [13,18]. In contrast, EMCOR and Stantec emerged as leaders in meeting this metric. EMCOR disclosed that 173 projects were certified under standards such as LEED, BREEAM, Green Globes, and Envision [14]. Stantec provided an even more comprehensive disclosure, including 958 LEED-certified projects, 125 Green Star-certified projects, 36 Net Zero-designed buildings, 14 Envision-certified projects, and numerous other certifications across various sustainability standards [11]. When examining active projects seeking certification, a similar trend of variability in disclosures was observed.

Companies such as AECOM, Quanta Services, and Jacobs discussed their efforts in this area but did not provide specific figures, falling short of the metric requirements.

On the other hand, EMCOR and Stantec stood out as leaders in this category, offering detailed and quantitative disclosures. EMCOR reported 352 active projects seeking certification, demonstrating a strong commitment to advancing sustainability standards across its portfolio [14].

Similarly, Stantec reported approximately 250 projects targeting various sustainability certifications, further emphasizing its leadership in sustainable practices [11].

- IF-EN-410a.2. For the metric IF-EN-410a.2., which focuses on incorporating operational-phase energy and water efficiency considerations into project planning and design, most companies provided qualitative discussions, indicating a general recognition of the importance of operational efficiency while minimizing resource use.

However, some companies, such as Fluor and HDR, did not provide sufficient detail in their disclosures, which points to areas for improvement. In contrast, AECOM provides strong examples of integrating energy and water efficiency throughout its project lifecycles. In its sustainability report, AECOM stated: "We advise on water, green design, next-generation transportation, and renewable energy projects that, in the aggregate, represent approximately 60% of our Net Service Revenue" [10].

Similarly, HOK has adopted a comprehensive approach to energy and water efficiency, leveraging building science, climate analysis, environmental modeling, life-cycle analysis, and advanced design strategies to enhance sustainability across project lifecycles [19].

Notably, Bechtel was marked as "Yes" for this metric in the analysis due to its mention of operational-phase energy and water efficiency. However, it was ultimately categorized as "Not Disclosed" because its discussion lacked sufficient detail and did not fully align with the metric's requirements.

In contrast, Jacobs was categorized as "Partially Disclosed" because, while it did not fully meet expectations for other metrics, it provided a more comprehensive discussion for this specific metric.

For example, in the Environmental Impact in Project Design and Delivery section of Jacobs Fiscal Year 2022 ESG Data Disclosures, the company outlined the use of its Business Management System.

This system is an efficient approach to project delivery, highlighting a structured framework-based approach for addressing energy and water efficiency considerations. These examples illustrate the varying levels of detail in disclosures and the importance of

aligning with specific metrics to ensure meaningful and transparent reporting.

- IF-EN-410b.1. For the metric IF-EN-410b.1., which pertains to the backlog of hydrocarbon-related projects, several companies disclosed specific quantitative figures, showcasing transparency in their reporting practices.

Quanta Services and Stantec stood out by offering percentages and detailed examples of projects, presenting a more comprehensive view of their backlogs. Among the best-reported data, AECOM disclosed approximately \$252 million in hydrocarbon-related projects [10], while EMCOR reported \$148 million, primarily through its industrial services for refineries and petrochemical plants [14].

Quanta Services indicated that 22% of its total backlog, valued at \$30.11 billion, is associated with hydrocarbon-related projects [12]. Stantec reported a hydrocarbon-related backlog of \$167 million (2.7% of its total backlog), including projects such as pipeline design, regulatory compliance, remediation, and environmental and social protection work that supports continued hydrocarbon development [11].

IF-EN-410b.1. also focuses on the backlog for renewable energy projects. Companies that disclosed hydrocarbon-related backlogs also provided data on their renewable energy projects, reflecting a balanced approach to energy. AECOM reported approximately \$102 million in renewable energy projects [10], while EMCOR disclosed a significantly larger figure of \$649 million.

EMCOR's renewable energy portfolio includes solar, wind, biofuel, and waste-to-energy installations, which generated \$440 million in revenue in 2023 [14]. Quanta Services identified 27% of its total backlog, valued at \$30.11 billion, as renewable energy projects, emphasizing its focus on sustainable energy solutions [12].

Similarly, Stantec reported a renewable energy backlog of \$254 million (4.1% of its total), with projects spanning hydropower, wind, solar, geothermal, battery storage, smart grids, and energy recovery [11].

- IF-EN-410b.2. For IF-EN-410b.2, which covers Backlog Cancellations Associated with Hydrocarbon-Related Projects, very few companies provided any data on backlog cancellations. This lack of reporting makes it difficult to understand the financial risks associated with hydrocarbon projects.

EMCOR and Stantec did not report any significant backlog cancellations, indicating that they either had no relevant cancellations or chose not to disclose them. Regardless, this area highlights the need for more comprehensive reporting, particularly in terms of financial risks related to fluctuating markets and regulatory changes.

- IF-EN-410b.3. For the metric IF-EN-410b.3., concerning the backlog for non-energy projects associated with climate change mitigation, companies such as Stantec and Quanta Services demonstrated detailed analysis and transparent reporting. The most extensive data for this metric came from AECOM, Quanta Services, and Stantec. AECOM reported an approximate backlog of \$4.9 billion, encompassing projects related to climate change adaptation and resilience, energy efficiency, transit modernization, environmental management and restoration, green building design, disaster resilience, and recovery [10].

Quanta Services reported that 51% of its total backlog of \$30.11 billion was associated with Electric Power Infrastructure Solutions projects, which included system modernization, electrical grid hardening, renewable energy facilitation, and electrification initiatives contributing to climate change mitigation [12]. Stantec provided the most comprehensive reporting, with \$1 billion (16.7%) of its backlog dedicated to climate change mitigation-related project types such as alternative transportation, energy efficiency, and climate strategy.

Additionally, \$807 million (12.8%) of Stantec's backlog focused on climate change adaptation projects, including coastal resilience, green infrastructure, nature-based solutions, and water management strategies such as flood risk reduction and water reuse. Together, Stantec's climate action efforts, including renewable energy, climate change mitigation, and climate change adaptation, accounted for \$2.1 billion (33.6%) of its year-end backlog.

These projects spanned all business units and geographies, reflecting a robust and diversified approach to addressing climate challenges [11].

The analysis shows that while some companies provide detailed and comprehensive disclosures aligned with SASB standards, others lack specific quantitative data and detailed discussions of their sustainability practices. Companies like EMCOR and Stantec stand out for their thorough reporting and alignment with SASB metrics, whereas companies like Bechtel, Fluor, and HDR need to improve their disclosures to meet industry standards.

4.5. Business ethics

Entities in the construction and engineering industry face extensive risks related to bribery, corruption, and anti-competitive practices due to factors such as global operations, complex project financing, and competitive bidding processes [8]. Ethical breaches, such as bribing officials or engaging in unethical practices, can lead to regulatory investigations, fines, and reputational damage. Companies with poor ethical records may be excluded from future projects, resulting in lost revenue.

To mitigate these risks, companies need to foster an ethical culture through employee training, strong governance, and internal procedures, policies, and controls.

- IF-EN-510a.1. This quantitative disclosure focuses on the quantity and value of active projects in countries ranked in the bottom 20 by the Corruption Perception Index (CPI). When there is a non-nil quantitative disclosure, additional commentary is needed to assess the context and nature of the disclosure, ensuring greater clarity.

Three companies fully disclosed, two companies with partial disclosure, and six without any relevant disclosures on this topic. The entities who achieved full disclosure all had nil disclosures, whereas AECOM and Stantec had active projects in countries identified in the bottom 20 of the CPI.

These companies only achieved partial disclosure, given the lack of detail in their qualitative discussion. While Stantec provided a better quality of information by specifying the country and type of project, it still did not provide a discussion on its approach to managing ethical risks specific to these countries [11]. This was required by the standard and, as a result, despite providing some information, was still only partially complete.

- IF-EN-510a.2. is a quantitative disclosure focusing on the value of monetary loss due to bribery, corruption, and anti-competitive practices. There were five companies with a disclosure of nil monetary losses associated with bribery, corruption, or anti-competitive practices, with the remaining not disclosing any information.

The best-reported data were the companies that provided a quantitative measure for the value of monetary loss rather than providing a statement or referring to a different section of the report. AECOM was the only company that did not provide details within the report itself and instead referred the reader to their annual report.

Although AECOM incurred no fines, its current method of disclosure could lead to a lack of transparency if fines were to occur in the future.

- IF-EN-510a.3. is a qualitative disclosure detailing the policies and practices for preventing bribery, corruption, and anti-competitive behavior, specifically concerning the project bidding process. It also requires information on the relevant management systems and practices in place.

This metric has a broad scope of potentially relevant information; however, none of the analyzed companies scored a 1 or 2 for this standard. These scores were attributed to the fact that many companies reference general legislation rather than policies and practices specifically related to the project bidding process. In other cases, companies fail to provide any relevant information in their sustainability reports.

For example, the Foreign Corrupt Practices Act (FCPA), an extensive piece of US anti-bribery and corruption law, was frequently referenced by companies [20].

However, a gap exists because legal and ethical actions, while overlapping, are not identical and contain unique elements [21]. Consequently, although referencing this legislation is relevant, it does not directly address the IF-EN-510a.3 metric.

As a result, the inclusion of this legislation, although relevant, does not specifically address the topic of the standard regarding the project bidding process and the actions taken to prevent unethical behavior. Another observation was that EMCOR did not include this material metric within their sustainability report despite disclosing information with SASB and the other elements of the business.

There is significant room for improvement among the 10 companies analyzed, particularly regarding IF-EN-510.a.3. For private companies that do not disclose the relevant information, the ability to obtain this information does not appear to be a limiting factor for the first two Business Ethics disclosure topics. This is because there is an overlap between SASB and financial reporting requirements. For instance, under US Generally Accepted Accounting Principles (GAAP), companies are required to disclose all material information and maintain comprehensive accounting records [22]. This includes fines and litigation incurred, as well as tracking revenue and expenditures associated with operations, including those in corrupt countries.

Thus, if accessibility to data is not a disclosure barrier for private companies, then additional research is required to identify other possible barriers preventing these companies from disclosing this information. For public companies currently reporting under SASB, there is an opportunity to differentiate themselves from competitors by leading in ethical behavior and improving the quality of their disclosures.

5. Discussion

To improve sustainability reporting across the construction and engineering industry, companies should adopt comprehensive and standardized approaches that address SASB material topics. Implementing a robust Environmental Management System (EMS), such as an ISO 14001-certified framework, provides a systematic approach to identifying and mitigating environmental risks while promoting ecological design principles [23].

This includes using sustainable materials, nature-based solutions, and energy-efficient construction techniques to minimize ecological harm. Transparent public reporting of environmental performance, such as Fluor's achievement of net-zero emissions, builds trust and aligns with SASB standards [13].

Digitalization offers significant potential to enhance transparency and accountability in Product Quality & Safety and Employee Health & Safety reporting. Tools like Building Information Modeling (BIM) improve documentation, identify safety risks, and reduce rework costs, with studies suggesting BIM can enhance project outcomes by up to 70% [24]. Companies should also implement regular third-party safety audits and extend SASB-aligned reporting to supply chain partners, as consistent monitoring and compliance ensure robust safety practices across operations.

Furthermore, reporting frameworks should incorporate more quantifiable metrics, such as the number of projects certified under sustainability standards or operational efficiency improvements, to provide stakeholders with actionable insights.

For Lifecycle Impacts of Buildings & Infrastructure, it is essential to adopt a holistic and quantitative approach to sustainability reporting. Companies should integrate lifecycle assessment (LCA) methodologies into their design and management practices to capture the environmental impacts across the entire building lifecycle, from material extraction to deconstruction. Study [25] states that integrating LCA can identify opportunities to reduce embodied carbon and operational energy.

Furthermore, adopting energy modeling tools and standards such as LEED and WELL certification can provide verifiable benchmarks for sustainability. The incorporation of smart technologies, such as digital twins, can improve resource efficiency during both the construction and operational phases [26].

Additionally, For Product Design & Lifecycle Management of Climate Impacts of Business Mix, a comprehensive strategy is critical to balancing conventional energy projects with renewable energy and climate-resilient solutions. Companies must align their business portfolios with net-zero pathways, as outlined in the IPCC's Sixth Assessment Report [27].

This can be achieved by increasing the share of renewable energy projects in backlogs and reporting financial metrics, such as investments in climate adaptation and mitigation initiatives. A movement towards these goals would demonstrate a company's commitment to meeting its climate targets and adapting to evolving sustainability demands.

Finally, strengthening Business Ethics reporting is essential for transparency and stakeholder trust. Companies should disclose detailed policies and control systems to address unethical behavior, particularly in the project bidding processes, and conduct third-party audits to ensure compliance [28]. For public companies, achieving full SASB compliance may require fewer operational changes, but private firms must address barriers to disclosure to align with industry best practices.

By integrating these recommendations, construction and engineering firms can enhance sustainability reporting across all material topics, demonstrating leadership in transparency and alignment with SASB standards [29].

6. Conclusion

Ultimately, the findings from this study on materiality disclosure would not only enhance academic knowledge but also offer practical recommendations for construction & engineering companies to improve the quality of their sustainability reporting. This research underscores the critical gaps and inconsistencies in sustainability reporting practices within the North American construction and engineering industry, particularly in adherence to SASB material topics.

While some companies demonstrate leadership through detailed and transparent disclosures, such as EMCOR and Stantec, the overall level of disclosure remains inconsistent across Ecological Impacts, Product Quality & Safety, Employee Health & Safety, Product Design & Lifecycle Management, and Business Ethics. The findings highlight the urgent need for the industry to adopt robust frameworks like ISO 14001-certified EMS, digital tools like BIM, and comprehensive policies for ethical governance to enhance transparency and accountability.

Future research should focus on differences between private and public reporting under SASB, alongside understanding the barriers and challenges faced by companies in sustainability reporting. Transparent, consistent reporting is essential for mitigating ESG risks, meeting regulatory requirements, and addressing the growing demand for corporate accountability in addressing global sustainability challenges.

This study provides a roadmap for companies to elevate their reporting standards and align with best practices, ultimately fostering a more sustainable future for the construction and engineering sector.

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