Materiality Assessment as a Governance Lens for the Twin Transition: A Cross-sector Analysis

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Abstract: The European Union's Twin Transition agenda encourages organizations to integrate both digitalization and circular economy principles into their core sustainability strategies. How companies reflect these two dimensions through their materiality processes and how stakeholder engagement contributes to such prioritization represents a rich area for empirical investigation. This study examines how Italian sustainability leaders operationalize the twin transition through materiality assessment and CEO strategic communication, using content analysis of sustainability reports published by Sustainability Leader companies across different sectors: service-oriented sectors and manufacturing-intensive sectors. The analytical framework operates at two complementary levels: materiality assessment, explored through explicit topic identification, disclosure depth, and the relationship between stakeholder engagement and materiality outcomes; and CEO letters, examined as strategic signaling instruments that reveal which twin transition themes top management considers most salient. Findings reveal a systematic cross-sector pattern in how circular economy and digital transformation are embedded as material topics, shaped by sector-specific strategic and regulatory contexts. CEO messages further illuminate the strategic framing of twin transition priorities, offering insight into the narratives through which leaders anchor sustainability commitments. Stakeholder engagement quality appears broadly consistent across sectors, suggesting that thematic differentiation is driven more by industry-specific pressures than by differences in engagement practices. These patterns offer valuable insights into how materiality processes and executive communication jointly translate the twin transition agenda into corporate sustainability priorities, and what this implies for the inclusiveness and balance of sustainability decision-making among acknowledged reporting leaders. The study contributes to the governance and ESG literature by advancing understanding of materiality assessment and CEO communication as interconnected strategic governance instruments.

Keywords: Materiality assessment, Twin transition, Circular economy, Stakeholder engagement, ESG reporting

1. Introduction

The European Union's Twin Transition agenda, which simultaneously pursues green and digital transformation, has positioned Circular Economy (CE) principles and Digitalization (DT) as two key pillars of the corporate sustainability mandate. Whether companies acknowledged as sustainability leaders genuinely integrate both dimensions into their materiality assessments, or whether they systematically foreground the dimension most aligned with their sector's operational logic, constitutes an empirically underexplored and governance-relevant question (Garst et al., 2022). The Corporate Sustainability Reporting Directive (CSRD, 2022/2464/EU) and the European Sustainability Reporting Standards (ESRS) formalizes the twin transition expectation through a double-materiality logic, requiring companies to assess topics for both their societal and environmental impact and their financial relevance (Muench et al., 2022; Hammerschmidt, 2025). The corporate accountability literature has, however, long documented persistent gaps between sustainability rhetoric and substantive disclosure (Sisdyani et al., 2025; Tariq, 2025), and recent evidence suggests that materiality processes may still be shaped more by sector convenience than by genuine stakeholder-driven prioritization (Giacomini et al., 2025). Whether acknowledged leaders are genuinely meeting this dual obligation across both CE and DT remains, therefore, a consequential and largely unexamined question in the Italian context. This study addresses this gap through content analysis (Mayring, 2004) of 43 sustainability reports from companies listed in the Il Sole 24 Ore Sustainability Leaders ranking. An original codebook is developed to operationalize CE and DT disclosure depth and engagement quality across twelve ordinal variables, enabling systematic comparison across four sectors. The four sectors were selected to represent contrasting industry contexts along the Twin Transition spectrum. Specifically, Banking and Insurance represent service-oriented sectors in which digital technologies constitute the primary operational infrastructure and a key source of competitive advantage (Casu and Girardone, 2025). Chemistry and Automotive Supply Chain represent manufacturing-intensive sectors, where production processes are directly exposed to raw material constraints, waste regulation, and carbon pricing (Carbonell, 2024; Bühler et al., 2025). As a result, CE practices are expected to play a more central operational role. Materiality assessment in the Twin Transition context sits at the intersection of two conflicting logics: the GRI principle of stakeholder inclusiveness requires material topics to emerge from meaningful engagement (GRI 1, 2021), yet sector affiliation rather than stakeholder input is often the strongest predictor of disclosure content

(Hahn and Kühnen, 2013). These tensions call for explicit theoretical framing, and this study integrates three complementary lenses. Stakeholder Theory (Freeman, 1984) holds that material topics should emerge from the concerns of those affected by the firm; Institutional Theory, through the concept of coercive, mimetic, and normative isomorphism (DiMaggio and Powell, 1983), predicts a countervailing force: organisations converge on sector-specific reporting conventions, so that materiality may mirror field-level legitimacy pressures rather than stakeholder salience, consistent with Hahn and Kühnen (2013), who identify sector affiliation as among the strongest determinants of disclosure content. Legitimacy Theory (Suchman, 1995; Deegan, 2002) adds that disclosure can be deployed symbolically to secure social approval, decoupling reported commitment from substantive practice (Meyer and Rowan, 1977; O'Dwyer, 2005).

Each lens maps onto a distinct research question:

- *RQ1: To what extent do Italian sustainability leaders identify CE and DT as material topics, and with what depth of disclosure in terms of sub-themes, terminology, and quantified targets?*
- *RQ2: Do systematic cross-sector patterns emerge in CE versus DT disclosure depth?*
- *RQ3: Are sustainability leaders genuinely inclusive in their materiality decision-making, as evidenced by stakeholder engagement depth and its integration into materiality outcomes?*

Stakeholder Theory frames the normative expectation tested in RQ3 since engagement should shape materiality outcomes while Institutional Theory accounts for the sector-specific patterns examined in RQ1 and RQ2, where sector affiliation, not engagement, appears to drive disclosure. Legitimacy Theory explains the mechanism (symbolic, decoupled engagement) through which this tension between stakeholder-driven expectation and institutionally patterned outcome is resolved in practice. The remainder of the paper follows this logic: Section 2 completes the theoretical background; Section 3 presents the methodology; Section 4 reports results, organised around the three RQs; Section 5 discusses the findings against the three theoretical lenses just introduced and their implications, and concludes.

2. Theoretical Background

Materiality in sustainability reporting has evolved from single materiality (financial relevance) to double materiality, which considers both financial implications and organisations' societal and environmental impacts (European Commission, 2019). GRI 3 (2021) defines a topic as material if it reflects significant impact or poses financial risk. Implementation remains uneven across organisations. Farooq et al. (2021) find that the quality of materiality assessment disclosures is highly heterogeneous, varying according to firm size, sector, and the degree of GRI adoption.

As materiality assessment has become a cornerstone of sustainability reporting, scholars have increasingly employed content analysis to evaluate how organisations disclose and prioritise material topics. Content analysis is the dominant methodology for operationalising disclosure depth (De Villiers and Van Staden, 2006), typically relying on ordinal scoring systems to measure disclosure along a continuum from no disclosure to comprehensive reporting. Nevertheless, disclosure quality remains highly variable, even among recognised sustainability leaders (Giacomini et al., 2025). Among the sustainability issues increasingly recognised as material, the CE has become a foundation of European environmental policy, formalised in the Circular Economy Action Plan (European Commission, 2020) and embedded in ESRS E5. CE encompasses strategies ranging from waste reduction and recycling to industrial symbiosis and regenerative design (Geissdoerfer et al., 2017; Menichini et al, 2026). Its materiality, however, differs across sectors. For manufacturing industries, CE is operationally central, whereas for financial services it is addressed more indirectly through financed emissions and portfolio decarbonisation (UNEP FI, 2021; Moneva et al., 2023). Alongside CE, digital transformation (DT), encompassing artificial intelligence, the Internet of Things (IoT), cloud computing, and cybersecurity, has emerged as a material sustainability topic in its own right (Vial, 2019; Menichini and Strollo, 2024). Regulatory frameworks such as the Digital Operational Resilience Act (DORA, 2022) and the General Data Protection Regulation (GDPR) elevate cybersecurity and data governance to board-level risk issues for financial institutions. In industrial sectors, by contrast, Industry 4.0 technologies primarily reshape production efficiency with a significant sector-dependent framing (Menichini et al., 2024); Varriale et al. (2025) confirm the cross-sectoral relevance of digital transformation as an enabler of SDG achievement, with implications for how DT is prioritised within corporate sustainability strategies. Importantly, CE and DT should not be viewed as independent dimensions. The European Union's Twin Transition framework (European Commission, 2021) conceptualises the two as mutually reinforcing, with digital technologies enabling circular business models while circular principles promote the sustainability of digital infrastructures (Hammerschmidt, 2025; Muench et al., 2022). Despite this

growing conceptual convergence, empirical evidence examining whether companies disclose both dimensions with comparable depth remains limited. CE and Industry 4.0 practices are increasingly co-deployed, though disclosure coherence remains heterogeneous across sectors (Sisdyani et al., 2025; Tariq, 2025). The challenge is embedded within the broader concept of corporate accountability, which requires organisations to account to society for the consequences of their actions (Odongo and Wang, 2018). Consistent with this perspective, the GRI principle of stakeholder inclusiveness requires material topics to be identified through meaningful stakeholder engagement (GRI 1, 2021) thus raising a fundamental question: does sustainability leadership reflect substantive stakeholder inclusiveness or merely procedural compliance with reporting standards? The distinction echoes a broader debate on the relationship between disclosure quality and genuine commitment: volume and completeness can decouple from substantive outcomes (Calabrese et al., 2020). Hahn and Kühnen (2013) identify sector affiliation as one of the strongest predictors of sustainability disclosure, suggesting that sector-specific logics outweigh stakeholder-driven prioritisation even among advanced reporters.

3. Methodology

The sample consists of 43 Italian companies listed in the 'Il Sole 24 Ore 2024 Sustainability Leaders' list (https://lab24.ilsole24ore.com/leader-sostenibilita/2024), which identifies companies distinguished for reporting quality and sustainability practices through an independent panel assessment. Inclusion provides an externally validated signal of sustainability leadership. All companies had published a GRI-aligned sustainability report or Non-Financial Statement (NFS) for reference year 2023. The selected sample spans four sectors: Banking (n = 28, 65.1%), Insurance (n = 5, 11.6%), Chemistry (n = 6, 14.0%), and Automotive supply chain (n = 4, 9.3%). Banking overrepresentation reflects the Italian NFS reporting landscape, where financial institutions are the most prolific mandatory reporters under Legislative Decree 254/2016. Following Mayring's (2004) approach to content analysis, which enables the systematic extraction of meanings and patterns from texts while combining quantitative scoring with qualitative contextual interpretation, the coding frame is structured around three dimensions: CE, DT, and Stakeholder Engagement (SE). Four variables are defined per dimension. Each dimension is operationalized through ordinal variables specifying scoring anchors, data sources, and operationalization (Table 1).

Table 1: Codebook

Dimension	Variable	Data source	Weight	Scale	Operationalization
CE	CE_presence	Materiality section	35%	0–2	0 = absent (no CE reference in materiality section); 1 = implicit (environmental topics cited without CE label; e.g., energy efficiency, carbon emissions, …); 2 = explicit ("CE" or equivalent named as a material topic)
CE	CE_subtopics	Materiality section	25%	0–3	0 = none; 1 = 1 sub-theme; 2 = 2–3 sub-themes; 3 = ≥4 sub-themes. Reference sub-themes (each counted once). E.g., waste/recycling; energy/renewables; carbon/Scope 3/decarbonization; supply chain; resource efficiency; mobility; production/manufacturing; water; …
CE	CE_keywords	Materiality section + CEO letter to stakeholders	20%	0–3	0 = none; 1 = 1–2 distinct keywords; 2 = 3–5; 3 = ≥6. Counted across materiality section and letter to stakeholders. e.g., circular economy, net zero, LCA, Scope 3, decarbonization, recycling, EU taxonomy, life cycle, biomass, etc…
CE	CE_targets	Materiality section	20%	0–2	0 = none; 1 = generic environmental goal or SDG 12/13 cited without specific KPI; 2 = quantified CE KPI with year
DT	DT_presence	Materiality section	35%	0–2	0 = absent; 1 = implicit (technology topics cited without DT label, e.g., cybersecurity, privacy, generic innovation); 2 = explicit ("digitalization", "Industry 4.0" or equivalent named as a material topic)
DT	DT_subtopics	Materiality section	25%	0–3	0 = none; 1 = 1 sub-theme; 2 = 2–3 sub-themes; 3 = ≥4 sub-themes. Reference sub-themes (each counted once). E.g., cybersecurity/data protection; digital services/platforms; AI/automation/RPA; cloud/IoT/blockchain; fintech/open banking; innovation/R&D; Industry 4.0; …

Dimension	Variable	Data source	Weight	Scale	Operationalization
DT	DT_keywords	Materiality section + CEO letter to stakeholders	20%	0–3	0 = none; 1 = 1–2 distinct keywords; 2 = 3–5; 3 = ≥6. Counted across materiality section and letter to stakeholders. E.g., digitalization, artificial intelligence, cybersecurity, blockchain, IoT, machine learning, digital twin, …
DT	DT_targets	Materiality section	20%	0–2	0 = none; 1 = generic technology goal or SDG 9 cited without specific KPI; 2 = quantified DT KPI with numeric value and target year
SE	SE_methods	Stakeholder Engagement section	40%	0–16	Additive score: • one-to-one interviews +3 • focus group/workshop +3 • advisory panel, stakeholder council +3 • governance body involvement (Board of Directors, committee) +2 • survey/questionnaire online +2 • informal dialogue/listening +1 (if not already counted above) • benchmark/desk analysis +1 • social media/events/dedicated tools +1
SE	SE_specificity	Stakeholder Engagement section	30%	0–4	0 = absent (col empty); 1 = engagement mentioned, no process detail; 2 = method described, no participant or result detail; 3 = method + stakeholder categories + themes emerged or link to materiality; 4 = method + stakeholders + timing + sample size + results + explicit link to materiality prioritisation
SE	SE_n_groups	Stakeholder Engagement section	20%	0–7	Count of distinct stakeholder categories engaged. Near-synonyms merged into one category each. E.g., employees; clients/customers; suppliers/partners; shareholders/investors; institutions/regulators; local community; trade unions; media; industry associations; agents/distributors; governance/management; …
SE	SE_integration	Stakeholder Engagement section	10%	0–2	0 = no link between engagement and materiality stated; 1 = engagement stated as informing materiality without mechanism explained; 2 = explicit prioritization mechanism described (e.g., weighting, ranking adjustment, threshold)

Composite indices are calculated as weighted sums of normalised sub-variable scores:

Score CE = (CE_presence/2 × 0.35) + (CE_subtopics/3 × 0.25) + (CE_keywords/3 × 0.20) + (CE_targets/2 × 0.20)

Score DT = (DT_presence/2 × 0.35) + (DT_subtopics/3 × 0.25) + (DT_keywords/3 × 0.20) + (DT_targets/2 × 0.20)

Score SE = (SE_methods/16 × 0.40) + (SE_specificity/4 × 0.30) + (SE_n_groups/7 × 0.20) + (SE_integration/2 × 0.10)

The weight assigned to presence variables (35%) reflects the theoretical primacy of whether a topic is identified as material at all, consistent with Farooq et al. (2021). Weights for remaining sub-variables follow the principle of diminishing specificity. The coding process was conducted by three members of the research team, each coding the full set of reports independently. Inter-coder reliability was assessed using Krippendorff's α, with an acceptable threshold set at ≥ 0.70 (Krippendorff, 2004). The obtained value exceeded this threshold, indicating high agreement among coders. Discrepancies were discussed and resolved through structured consensus before finalising the coding. Construct validity was supported by anchoring scale levels to specific textual evidence and cross-referencing against the structured dataset.

4. Results

4.1 Descriptive Statistics by Sector

Table 2 presents mean scores and standard deviations by sector. Across the full sample, Score CE averages 0.470 (SD = 0.269), Score DT 0.548 (SD = 0.246), Score SE 0.428 (SD = 0.148). Italian sustainability leaders disclose more deeply on DT than on CE on average, with moderate and broadly homogeneous engagement quality across sectors.

Table 2: Descriptive statistics — Score CE, Score DT, Score SE by sector

Sector	n	Score CE mean (SD)	Score DT mean (SD)	Score SE mean (SD)	CE vs DT pattern
Banking	28	0.384 (0.240)	0.616 (0.216)	0.430 (0.145)	DT > CE (gap = −0.232)
Insurance	5	0.440 (0.167)	0.500 (0.314)	0.472 (0.141)	Balanced (gap = −0.060)
Chemistry	6	0.750 (0.148)	0.372 (0.203)	0.346 (0.120)	CE > DT (gap = +0.378)
Automotive supply	4	0.688 (0.361)	0.392 (0.289)	0.482 (0.212)	CE > DT (gap = +0.296)
Full sample	43	0.470 (0.269)	0.548 (0.246)	0.428 (0.148)	DT > CE overall

SD = standard deviation. Pattern: CE vs DT gap ≥ 0.10 defines direction; 'Balanced' = |gap| < 0.10.

4.2 Cross-sector Patterns (RQ2)

The most striking finding is a systematic inverse pattern between Score CE and Score DT across the four sectors. Banking presents the lowest CE score (0.384) alongside the highest DT score (0.616), a gap equal to −0.232 points. The pattern is consistent across sector logic: banking institutions predominantly identify digital transformation, cybersecurity, and data protection as material topics, while CE identification is absent or implicit in a majority of reports. Explicit CE identification as a material topic (CE_presence = 2) was found in only 18.6% of companies overall, and in just 10.7% of banking companies specifically. Insurance sits close to the CE = DT diagonal with a gap equal to −0.060, qualifying as Balanced under the ±0.10 threshold. The inverse pattern is equally consistent in Chemistry and Automotive supply chain, where CE scores are the highest in the sample (0.750 and 0.688) and DT scores are moderate.

4.3 Disclosure Depth (RQ1)

Addressing RQ1, explicit DT identification as material (DT_presence = 2) is achieved by 62.8% of companies; only 14.0% score zero. For CE, only 18.6% achieve explicit identification, while 20.9% show no CE content in their materiality section. CE sub-theme breadth averages 1.7 across the full sample, with most companies addressing one to two distinct CE themes, typically energy efficiency and carbon emissions. Quantified CE-specific targets (CE_targets = 2) remain the exception. DT sub-theme breadth averages 1.5, with most banking companies covering cybersecurity plus one or two additional themes.

4.4 Sector Visualisation

Figure 1 illustrates the sector-level CE–DT trade-off. Each large bubble represents a sector centroid; bubble size encodes the mean Score SE; Score CEO values annotate each centroid; a dashed diagonal marks the CE = DT equality reference. Banking and Insurance cluster above-left of the diagonal (high DT, low-to-moderate CE), while Chemistry and Automotive supply chain sit below-right (high CE, low DT). No sector centroid falls in the lower-left quadrant, indicating that all four sectors address at least one twin-transition dimension meaningfully.

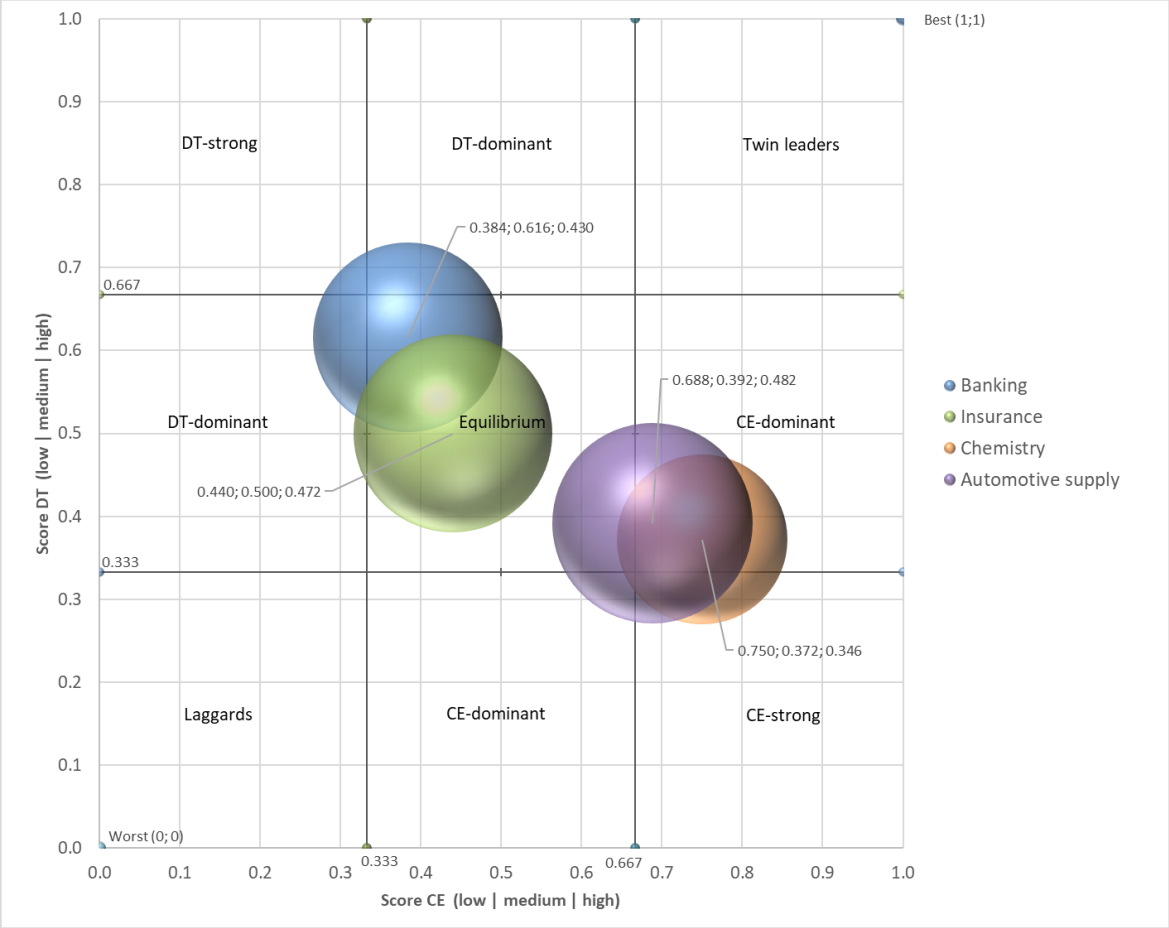


Figure 1: Sector bubble chart; mean Score CE (x-axis) vs mean Score DT (y-axis); bubble size = mean Score SE

4.5 Corporate Accountability and Stakeholder Inclusiveness (RQ3)

The relative homogeneity of Score SE across sectors, ranging from 0.346 (Chemistry) to 0.482 (Automotive supply chain), carries significant implications for corporate accountability. If engagement quality were the primary driver of material topic selection, sectors with deeper engagement would show more balanced CE–DT profiles. The absence of this pattern suggests that engagement processes in Italian sustainability leaders may be designed to validate pre-existing strategic narratives rather than to genuinely surface stakeholder concerns that challenge sector convenience. This is consistent with Farooq et al. (2021) and with the critical accounting literature on the formal use of stakeholder dialogue (O'Dwyer, 2005), and echoes recent findings that stakeholder engagement quality remains variable even among formally committed sustainability reporters (Giacomini et al., 2025). The inclusiveness question is particularly acute in Banking. Banking institutions engage on average 5 distinct stakeholder categories, among the widest in the sample, yet their CE disclosure depth is the lowest across all sectors (Score CE = 0.384). This divergence suggests that engagement breadth, namely who is formally consulted, does not translate into engagement depth, namely whether outcomes genuinely reshape materiality priorities (Saraswati et al., 2024). For sustainability leadership to be credible under a corporate accountability lens, engagement outcomes must demonstrably influence the content of materiality maps, including the elevation of cross-cutting topics such as CE that are increasingly demanded by regulators, institutional investors, and civil society (Bellucci et al., 2019).

5. Discussion and Conclusion

This study provides the first systematic, multi-sector evidence on CE and DT disclosure depth among Italian sustainability-reporting leaders, interpreted through the tension between stakeholder-driven inclusiveness and institutionally patterned, legitimacy-seeking disclosure. Three contributions, each mapped to a research question and its corresponding theoretical lens, follow. First (RQ1), the study establishes that explicit CE identification is achieved by only 18.6% of companies compared with 62.8% for DT, revealing a substantial materiality gap. The finding extends previous European evidence that CE remains weakly embedded in corporate

materiality assessments outside manufacturing-intensive sectors (Opferkuch et al., 2022; Vitolla et al., 2023). Institutional Theory explains this pattern: reporters disclose the Twin Transition dimension expected within their sector rather than covering both with comparable depth (DiMaggio and Powell, 1983). Second (RQ2), the analysis documents a systematic CE–DT sector trade-off, showing that sector affiliation rather than engagement quality drives disclosure depth. Banking and Insurance prioritise DT because digital governance, cybersecurity, and data protection are directly shaped by regulatory requirements, whereas Chemistry and Automotive supply-chain firms emphasise CE due to exposure to material efficiency, waste management, and carbon costs, confirming that sector affiliation drives disclosure content even among sustainability leaders (Hahn and Kühnen, 2013). Finally (RQ3), the study reveals that engagement breadth does not necessarily translate into balanced accountability. Banking institutions engage the widest range of stakeholders yet display the lowest CE disclosure depth, indicating that extensive engagement may legitimise existing priorities without materially reshaping disclosure agendas. The finding disconfirms the normative expectation set out by Stakeholder Theory (Freeman, 1984), namely that broader stakeholder involvement should translate into more balanced materiality outcomes. Read through Legitimacy Theory, the gap is better explained as decoupling (Meyer and Rowan, 1977): engagement functions here as a symbolic practice that secures procedural legitimacy without reshaping substantive disclosure priorities, consistent with evidence that stakeholder engagement disclosure often has little real effect on overall reporting quality (Dewi et al., 2023).The three findings show that the tension between stakeholder-driven inclusiveness and institutionally patterned, legitimacy-seeking disclosure, framed in Section 2, is resolved in practice in favour of the latter: sector affiliation, not stakeholder input, drives what gets disclosed, and engagement operates largely as a legitimating device. CE and DT continue to be prioritised separately, raising the question of whether DT should be framed as a standalone material topic or an enabling capability (Singhania et al., 2025).

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