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Development of a Materiality-Based ESG KPI Prioritization Framework for Industrial Organizations

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ABSTRACT

Industrial organisations must monitor and report many environmental, social and governance (ESG) indicators, yet not all carry equal relevance, and low-priority data collection diverts resources from genuine gaps. This paper develops a six-criteria framework for prioritising ESG key performance indicators (KPIs). It combines impact and financial materiality, as defined under the European Sustainability Reporting Standards, with regulatory relevance, operational criticality, stakeholder relevance and data availability. Eight KPIs are scored and combined into a KPI Priority Score, giving three dashboard tiers: greenhouse gas emissions (5.00) and occupational safety (4.17) in Tier 1; energy, water and waste in Tier 2; employee diversity, anti-corruption and community impact in Tier 3. Reweighting toward double materiality leaves the top four ranks unchanged (Spearman's $\rho = 0.97$). Compared with verified disclosure data for a five-company Indian industrial panel, occupational safety shows the larger gap between priority and disclosed completeness. The paper closes with a dashboard architecture, an economic-sustainability guide and specific recommendations.

Keywords: ESG KPI prioritisation, double materiality, multi-criteria scoring, sustainability reporting, industrial organisations

INTRODUCTION

Background and Context

A mid-sized industrial company preparing its annual sustainability disclosure today faces a genuinely large indicator set: the Global Reporting Initiative (GRI) alone publishes dozens of topic standards, the International Sustainability Standards Board's (ISSB's) IFRS S1 and S2 add financial-materiality-oriented disclosure requirements, India's own Business Responsibility and Sustainability Reporting (BRSR) format (Securities and Exchange Board of India [SEBI], 2023) specifies its own Core and Essential indicators, and companies with European operations or listings increasingly face the European Sustainability Reporting Standards' (ESRS) own extensive topical set (European Financial Reporting Advisory Group [EFRAG], 2023). Treating every indicator any one of these frameworks mentions as equally deserving of monitoring attention is neither financially nor operationally realistic, yet failing to identify which indicators genuinely warrant the highest monitoring priority risks exactly the gap defined in the problem statement below: a company may satisfy disclosure checklists while still missing the specific indicators most material to its own operational risk and stakeholder concern.

The difficulty is not only one of volume. The frameworks define materiality differently: the ESRS require a double-materiality assessment of both a matter's effects on people and the environment and its effects on the undertaking's finances (EFRAG, 2023), GRI 3 prioritises impacts only (GRI, 2021), and IFRS S1 and S2 address the needs of investors and other primary users of financial reports (ISSB, 2023a, 2023b). A topic-level assessment tells an organisation which sustainability topics matter, but not which individual, measurable environmental, social and governance (ESG) key performance indicators (KPIs) deserve scarce monitoring effort, how often they should be reviewed, or who should own them. Financial relevance varies by industry: firms with strong performance on financially material issues outperform firms with weak performance on

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them, while performance on immaterial issues shows no such link (Khan et al., 2016), which is why sector-specific guidance has been advocated (Eccles et al., 2012). Prioritisation is also economic: initiating voluntary non-financial disclosure has been followed by a lower cost of equity capital for firms with strong social-responsibility performance (Dhaliwal et al., 2011), but producing disclosure is costly, so effort should go where it is most valuable.

Problem Statement

The problem addressed is the absence of a transparent, reproducible method for deciding which ESG KPIs an industrial organisation should monitor most closely. Standards specify what may be disclosed and materiality assessments identify broad topics, but neither ranks individual KPIs by combining impact and financial materiality with regulatory exposure, operational control, stakeholder concern and data feasibility. An organisation can therefore satisfy a disclosure checklist while under-monitoring the indicators most material to its risk, and spend scarce resources on low-value data. A related problem is that priority and practice may diverge: a KPI that deserves the closest monitoring may still be disclosed incompletely.

Hypotheses

The study tests three hypotheses, each answering one question: can the criteria separate the KPIs (H1), is the result robust to weighting (H2), and does disclosure match priority (H3)?

H1 (discrimination). The KPI Priority Score spreads the eight KPIs over more than one point of the five-point scale and places them in all three dashboard tiers; the KPIs are not equally prioritised.

H2 (robustness). Tier 1 membership and the order of the four highest-ranked KPIs are unchanged when the two double-materiality criteria jointly carry a weight of 0.60 instead of one third, with a Spearman rank correlation of at least 0.90.

H3 (priority-disclosure gap). For the Tier 1 KPIs, disclosed completeness falls short of priority (a positive Priority-Disclosure Gap), and the shortfall is larger for occupational safety than for greenhouse gas emissions.

The hypotheses were specified with the framework and are tested descriptively on a screening-level set of eight KPIs; no statistical significance is claimed. H1 is tested in the KPI Priority Score results, H2 in the robustness analysis and H3 in the validation against disclosed practice; the Conclusion summarises each outcome.

Research Objectives

The study has four objectives.

O1. To define a six-criteria scoring design grounded in the ESRS, GRI, IFRS, BRSR and ISO standards.

O2. To compute a KPI Priority Score for eight KPIs and classify them into a three-tier dashboard hierarchy.

O3. To test the robustness of the ranking to an alternative weighting and to the influence of each criterion.

O4. To compare priority with verified disclosure completeness, and to derive a dashboard architecture and an economic-sustainability guide for stakeholders.

Significance of the Study

For industrial organisations, the framework gives sustainability, environment-health-safety and finance teams a reproducible basis for allocating monitoring effort and for explaining to boards and assurers why some KPIs receive continuous attention and others annual review. For standard-setters, the validation gap shows where prescribed disclosure and operational priority may diverge. For researchers, it offers a transparent structure whose scores and weights can be re-estimated with company data. For investors and lenders, it shows which indicators are most informative and where disclosure remains thin.

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Scope and Approach

This paper develops a six-criteria framework for prioritising ESG key performance indicators specifically, rather than the broader sustainability topics materiality assessments typically address. The six criteria, impact materiality and financial materiality, combined as formally defined double materiality under the European Sustainability Reporting Standards, regulatory relevance across the four major frameworks named above, operational criticality within ISO 14001 and 45001 management systems (International Organization for Standardization [ISO], 2015, 2018), stakeholder relevance, and data availability, are combined into a KPI Priority Score applied to eight candidate indicators spanning this panel's established environmental and social domains. The resulting three-tier dashboard hierarchy is then validated directly against this series' own previously verified disclosure-completeness findings for two of those eight indicators, testing whether a KPI this framework identifies as high priority is actually disclosed completely in practice, or whether priority and practice diverge. The paper proceeds as follows. The Literature Review grounds the six criteria in the standards, including the difference between GRI's impact-only materiality and the ESRS double-materiality construct. The Methodology sets out the KPI selection, the KPI Priority Score and tier formulas, and a table defining every symbol. The Results report the scoring matrix, ranking, tiers, robustness, criterion influence and validation against disclosed practice. The Discussion interprets the findings, examines organisational variation, offers a conceptual reading and an economic-sustainability guide, and sets out a dashboard architecture and the limitations. The Conclusion links the findings back to the hypotheses and sets out recommendations.

LITERATURE REVIEW

Double Materiality Under ESRS

The European Sustainability Reporting Standards, through ESRS 1's general requirements (EFRAG, 2023), formally define double materiality as comprising two distinct dimensions. Impact materiality assesses a sustainability matter's actual and potential effects on people and the environment, determined through the severity characteristics of scale, how grave or beneficial the impact is, and scope, how widespread it is, whether measured as geographic extent for environmental impacts or number of people affected for social impacts. Financial materiality, by contrast, assesses whether a matter triggers or could reasonably be expected to trigger material effects on the undertaking's financial position, performance, cash flows, access to finance or cost of capital, over the short, medium or long term, and explicitly extends beyond matters within the undertaking's direct control to risks and opportunities attributable to its wider business relationships. A matter is material under ESRS if it meets either threshold independently; the two assessments are related but neither is a precondition for the other.

GRI's Contrasting Impact-Only Materiality

GRI 3's own materiality concept (GRI, 2021), by contrast, is explicitly impact-only: an organisation's material topics are determined by prioritising its most significant actual and potential impacts on the economy, environment and people, with no separate, formally defined financial-materiality test comparable to ESRS's second dimension. This is a genuine conceptual difference rather than merely a difference in terminology, a topic can be GRI-material through impact alone while lacking the financial-materiality grounding ESRS would separately require, or vice versa, and a KPI prioritisation framework drawing on both standards families, as this paper's regulatory-relevance criterion does, must treat the two materiality concepts as related but non-identical inputs rather than collapsing them into a single notion of materiality.

IFRS S1/S2 and the Financial-Materiality Tradition

The International Sustainability Standards Board's IFRS S1 and S2 (ISSB, 2023a, 2023b), developed specifically for primary users of general-purpose financial reports, sit conceptually closer to ESRS's financial-materiality dimension than to GRI's impact-only tradition, requiring disclosure of sustainability-related risks and opportunities that could reasonably be expected to affect the entity's cash flows, access to finance or cost of capital. IFRS S2 specifically, covering climate-related disclosures, gives this paper's regulatory-relevance

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criterion a second, independent confirmation that greenhouse gas emissions carries financial-materiality weight beyond ESRS's own E1 standard, a convergence across two independently developed frameworks this paper's Results section treats as a meaningful signal rather than a coincidence.

Multi-Criteria Decision Analysis in Sustainability Prioritisation

Combining several distinct criteria into a single priority score, as this paper's KPI Priority Score does across six dimensions, follows the general logic of multi-criteria decision analysis, an established operations-research tradition for structuring decisions that cannot be reduced to a single natural metric. Saaty's Analytic Hierarchy Process (Saaty, 1980), the most widely applied multi-criteria decision framework in management and operations research, formalises exactly this structure: a decision problem is decomposed into a hierarchy of goals, criteria and alternatives, with priority weights derived for each criterion before alternatives are scored against them, a structure this paper's own design mirrors directly, Figure 1's hierarchy descending from the overall prioritisation goal through the six individual criteria to the eight candidate KPIs scored against each. Saaty's framework additionally formalises sensitivity analysis, testing whether a ranking is robust to changes in criterion weighting, as integral to rather than separate from the core method, directly anticipating this paper's own Equation 7 robustness check rather than that check being an ad hoc addition.

Applied here, each of the six criteria captures a genuinely distinct question, a KPI can score highly on impact materiality while scoring low on data availability, exactly the kind of multi-dimensional trade-off multi-criteria methods are designed to make explicit rather than obscure within a single, opaque composite judgement. This paper's own construction, Equation 1's simple unweighted mean (simple additive weighting with equal weights; Hwang & Yoon, 1981), is a deliberately simplified special case of the general multi-criteria framework Saaty formalises, equal weighting rather than Saaty's full pairwise-comparison procedure, chosen specifically for transparency and reproducibility given this paper's screening-level scope, with Equation 7's alternative weighting serving the sensitivity-testing role Saaty's own framework treats as essential to any multi-criteria result.

Voluntary Double-Materiality Adoption in This Panel

Beyond the standards themselves, this paper's own five-company panel provides direct evidence that double materiality is already an operational concept for at least some Indian industrial companies, independent of any domestic regulatory mandate to adopt it. Both JSW Steel and UltraTech Cement's own sustainability disclosures explicitly describe a double materiality assessment process by that name (UltraTech Cement Limited, 2026), indicating voluntary alignment with ESRS's specific methodology ahead of any BRSR requirement to do so, a pattern this paper's Discussion section returns to when interpreting this panel's own disclosure practice.

Materiality Is Not Uniform Across Organisations

Materiality is contextual. Khan et al. (2016) classify sustainability issues as material or immaterial by industry, and Eccles et al. (2012) argue for sector-specific standards for the same reason. Stakeholder theory adds that organisations differ in whom they treat as salient, since stakeholders gain priority through power, legitimacy and urgency (Mitchell et al., 1997), and that obligations to those affected are not limited to shareholders (Freeman, 1984). The determinants usually named in practice (impact significance, financial materiality, organisational relevance, operational importance, stakeholder interests and data availability) therefore enter any prioritisation with different weight in different organisations; the Discussion maps them to the six criteria of this framework.

METHODOLOGY

The framework proceeds in five stages: KPI candidate selection, six-criteria scoring, priority-score construction, tier classification, and validation against disclosed practice. Figure 1 sets out this workflow.

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This five-stage sequence is not an arbitrary workflow; it follows directly from the hierarchical decomposition Saaty's Analytic Hierarchy Process (Saaty, 1980) prescribes for any multi-criteria prioritisation problem. Saaty's own method begins by structuring a decision as a hierarchy descending from an overall goal, through the criteria by which alternatives will be judged, to the alternatives themselves, insisting that this structuring step precede any numerical scoring because the quality of a multi-criteria result depends as much on having decomposed the right criteria as on having scored them accurately. This paper's Figure 1 mirrors that structure directly: the overall goal, prioritising ESG KPIs for monitoring attention, sits at the top; the two double-materiality-grounded criteria and the four supporting criteria occupy the middle levels; and the eight candidate KPIs, scored against all six criteria simultaneously, occupy the base. Stages one and two of the five-stage sequence correspond to Saaty's hierarchy-structuring step, stage three to his scoring and synthesis step, and stages four and five extend the basic Saaty framework specifically for this paper's own purpose, translating a continuous priority score into a discrete, practically actionable dashboard tier, and then testing that translation against independently verified evidence rather than treating the scoring exercise as self-validating.

This plan-score-classify-validate progression also echoes, at a structural level, the plan-do-check-act logic underlying the ISO management-system standards this series' companion studies draw on directly: criteria structuring and scoring correspond to planning and execution, while tier classification and validation correspond to checking a result against independent evidence before treating it as final, a discipline multi-criteria scoring shares with operational management systems more broadly, even though the two traditions developed largely independently of one another.

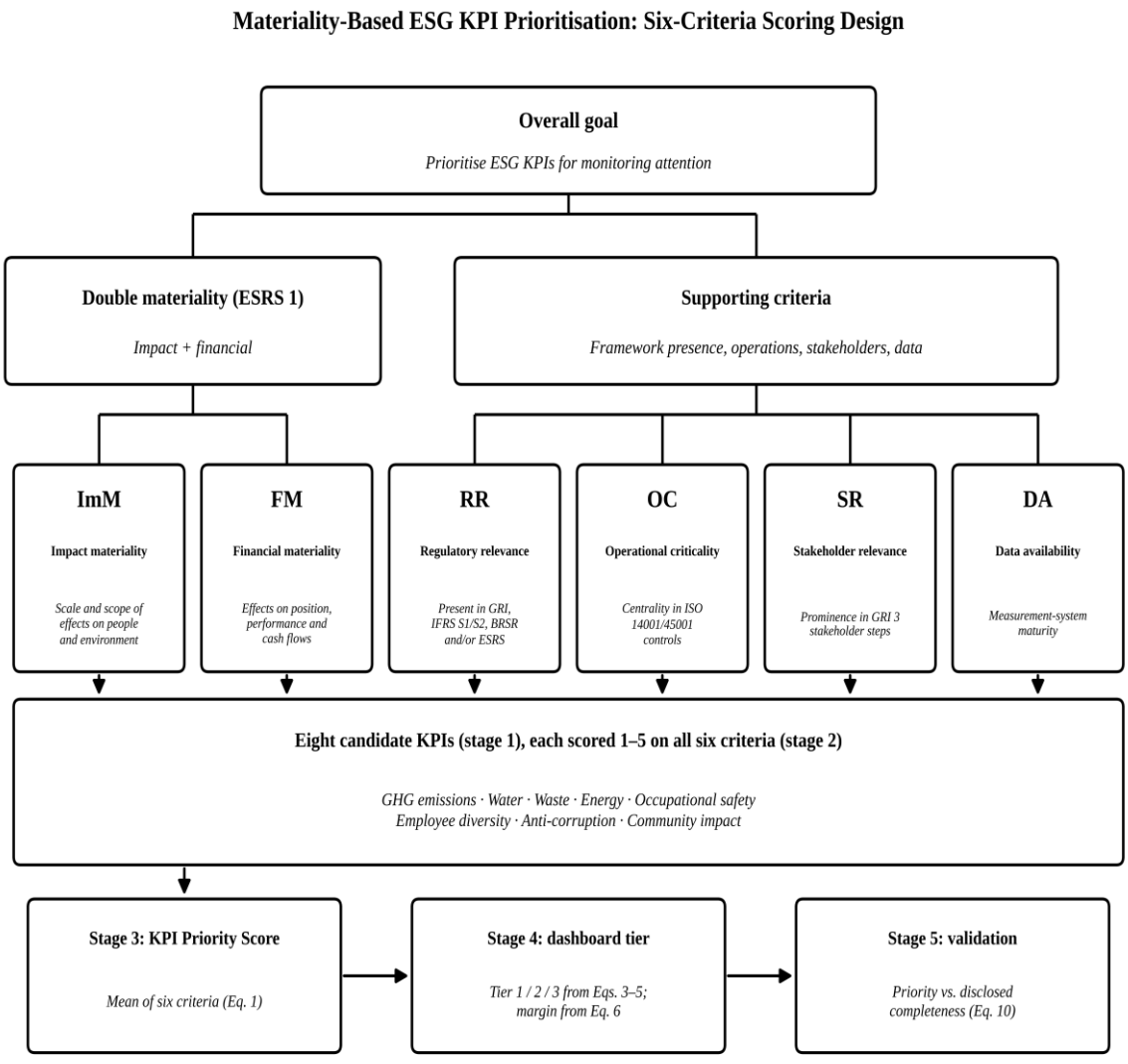


Figure 1: Materiality-based ESG KPI prioritisation, six-criteria scoring design

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Figure 1 reads from top to bottom. The overall goal, prioritising ESG KPIs for monitoring attention, is decomposed into the double-materiality pair, impact materiality (ImM) and financial materiality (FM), and four supporting criteria, regulatory relevance (RR), operational criticality (OC), stakeholder relevance (SR) and data availability (DA). The eight candidate KPIs, scored on all six criteria, form the base (stages 1 and 2). Their scores are combined into the KPI Priority Score (stage 3, Equation 1), mapped to a tier (stage 4, Equations 3 to 6) and compared with disclosed practice (stage 5, Equation 10).

Candidate KPI Selection

Eight KPIs were selected to span this series' established environmental and social domains: greenhouse gas emissions, water, waste and energy, drawn directly from the companion ESG-EHS integration study's environmental branch, occupational safety, drawn from that same study's safety branch, and employee diversity, anti-corruption and community impact, added specifically to extend coverage into social and governance domains this series' companion studies have not previously quantified, testing whether this framework's priority ordering holds beyond the indicators already validated elsewhere in this series.

Rationale for the Selection and for Differential Attention

The eight KPIs are a screening set, not an exhaustive list. They span the three ESG pillars and three types of evidence: KPIs with independently verified disclosure data in this series (greenhouse gas emissions, occupational safety), KPIs sharing the environmental-management evidence base of those two (energy, water, waste), and KPIs extending coverage to the social and governance pillars (employee diversity, anti-corruption, community impact). Every KPI is covered by both GRI and ESRS and seven of the eight by BRSR (Figure 6), so each is a genuine reporting candidate.

Unequal attention needs a scientific rationale, because a low-priority KPI is not an unimportant one. First, monitoring capacity is finite, and decision makers facing many demands settle for satisfactory rather than optimal outcomes (Simon, 1955); a tiered hierarchy makes that selection explicit and open to challenge. Second, evidence that financial performance is linked to material but not to immaterial sustainability issues (Khan et al., 2016) suggests that equal attention to every indicator dilutes the signal. Third, the framework separates monitoring intensity from reporting obligation: a Tier 3 KPI remains subject to any disclosure that a standard or regulation requires, and only the cadence, escalation level and depth of internal monitoring change (Table 6).

The Six Scoring Criteria

Each KPI is scored on a one-to-five scale against six criteria, each grounded in a specific standard or finding reviewed above.

1. Impact Materiality (ImM) and Financial Materiality (FM): scored separately following ESRS 1's own two-dimensional definition (EFRAG, 2023), ImM against the scale and scope of the KPI's actual and potential effects on people and the environment, FM against whether the KPI plausibly triggers material effects on financial position, performance or cash flows.
2. Regulatory Relevance (RR): scored against how many of the four frameworks, GRI, IFRS S1/S2, BRSR and ESRS, require or substantively address the KPI, with a higher score for KPIs appearing across more frameworks (EFRAG, 2023; GRI, 2021; ISSB, 2023a, 2023b; SEBI, 2023).
3. Operational Criticality (OC): scored against the KPI's centrality within ISO 14001 or ISO 45001 operational control clauses (ISO, 2015, 2018), consistent with the clause mapping this series' companion ESG-EHS study establishes.
4. Stakeholder Relevance (SR): scored against the KPI's prominence in GRI 3's stakeholder engagement and impact-identification steps (GRI, 2021).
5. Data Availability (DA): scored against this series' own verified findings on measurement-system maturity for each KPI, for example LTIFR's status as a long-established, routinely computed safety

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metric scoring higher than a separately computed fatality rate this series' companion study found only one of five companies disclosed.

Mathematical Modelling

The KPI Priority Score for indicator k is the unweighted mean of its six criterion scores:

$$KPS_k = \frac{ImM_k + FM_k + RR_k + OC_k + SR_k + DA_k}{6} \quad (1)$$

where k = 1, ..., 8 indexes the KPIs; KPS_k is the KPI Priority Score (one-to-five scale; higher means higher monitoring priority); and ImM_k, FM_k, RR_k, OC_k, SR_k and DA_k are the integer criterion scores, from 1 (lowest) to 5 (highest), defined above. Equation 1 is simple additive weighting (Hwang & Yoon, 1981) with each criterion weighted 1/6.

Regulatory Relevance itself has a direct quantitative basis rather than resting on unstructured judgement: the Framework Coverage Index counts how many of the four frameworks named above substantively address a given KPI, expressed as a fraction of the maximum possible coverage of four:

$$FCI_k = \frac{GRI_k + IFRS_k + BRSR_k + ESRS_k}{4} \quad (2)$$

where FCI_k ranges from 0 to 1, and GRI_k, $IFRS_k$, $BRSR_k$ and $ESRS_k$ are binary indicators equal to 1 if the framework addresses KPI k and 0 otherwise. FCI anchors Regulatory Relevance: RR uses the same one-to-five band as the other criteria, so that a KPI present in all four frameworks and one present in none sit at opposite ends. In Table 2 the RR scores are weakly monotonic in FCI (higher coverage never gives a lower RR) but are not a strict rescaling, RR = 1 + 4 × FCI: the scoring also weighed how directly each framework treats the KPI, so KPIs with the same FCI can differ by one point (greenhouse gas emissions 5, energy 4). The Results section tests how much this judgement matters.

Each KPI is assigned to one of three dashboard tiers directly from its KPS, giving this study's required practical dashboard hierarchy a transparent, reproducible threshold rule:

$$Tier(KPS_k) = Tier\ 1,\ KPS_k \geq 4.0 \quad (3)$$

$$Tier(KPS_k) = Tier\ 2,\ 3.0 \leq KPS_k < 4.0 \quad (4)$$

$$Tier(KPS_k) = Tier\ 3,\ KPS_k < 3.0 \quad (5)$$

where Tier(KPS_k) is the dashboard tier of KPI k; the thresholds 4.0 and 3.0 are derived from the one-to-five scale in the Results section.

A KPI's distance from the nearer of its two surrounding thresholds, its Tier Margin, identifies how robust that KPI's specific tier placement is to a small change in its underlying scores, a question Equations 3 through 5's discrete classification alone cannot answer:

$$Margin_k = min(|KPS_k - 4.0|, |KPS_k - 3.0|) \quad (6)$$

where $|\cdot|$ is the absolute value, min(·) selects the smaller of the two distances, and $Margin_k$ is measured in score points.

A KPI sitting exactly on a threshold has a Margin of zero, the weakest possible evidence for its assigned tier; a KPI far from either threshold has a correspondingly larger Margin and a correspondingly more robust tier placement. The Results section below reports this value for all eight KPIs directly.

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To test the sensitivity of this ranking to the specific equal weighting Equation 1 applies, an alternative, double-materiality-weighted score assigns combined weight 0.60 to the two ESRS-grounded core criteria, split evenly, against 0.10 to each of the remaining four:

$$KPS_{alt,k} = 0.30ImM_k + 0.30FM_k + 0.10RR_k + 0.10OC_k + 0.10SR_k + 0.10DA_k \quad (7)$$

where $KPS_{alt,<i>k</i>}$ is the double-materiality-weighted score of KPI *k*; the six weights are non-negative and sum to 1. The combined weight of 0.60 on ImM and FM is a deliberate stress test, not an elicited weighting; weights elicited from practitioners by pairwise comparison (Saaty, 1980) could replace it.

Two complementary statistics formalise how closely Equation 7's alternative ranking tracks Equation 1's equal-weighted ranking. The Pearson product-moment correlation (Pearson, 1895) tests agreement in the underlying values:

$$r = \frac{\Sigma(KPS_k - KPS)(KPS_{alt,k} - KPS_{alt})}{\sqrt{\Sigma(KPS_k - KPS)^2 \, \Sigma(KPS_{alt,k} - KPS_{alt})^2}} \quad (8)$$

while Spearman's rank correlation (Spearman, 1904) tests agreement in the ordering itself, independent of the specific values, the more directly relevant test given this study's practical concern is tier placement and ranking rather than the precise numerical score:

$$\rho_s = 1 - \frac{6\Sigma D^2}{n(n^2 - 1)} \quad (9)$$

In Equation 8, *r* is the Pearson coefficient (−1 to +1), the sums run over the eight KPIs, and the bar denotes the mean over the eight KPIs. In Equation 9, ρ_s is Spearman's coefficient (−1 to +1), *D* is a KPI's rank difference between the two weightings, and $n = 8$ is the number of KPIs ranked; tied KPIs receive the mean of the ranks they span. The Results section reports both statistics directly.

Table 1 lists every symbol used in Equations 1 to 11 with its range and its basis.

Table 1: Notation, ranges and sources for the symbols used in Equations 1 to 11

Symbol	Meaning	Range or unit	Basis or source
k	Index of the candidate KPI	1 to 8	Candidate KPI selection (this paper)
$ImM_{<i>k</i>}$, $FM_{<i>k</i>}$	Impact materiality and financial materiality scores of KPI *k*	1 to 5	ESRS 1 double-materiality definition (EFRAG, 2023)
$RR_{<i>k</i>}$	Regulatory relevance score	1 to 5	Coverage in GRI, IFRS S1/S2, BRSR and ESRS (EFRAG, 2023; GRI, 2021; ISSB, 2023a, 2023b; SEBI, 2023)
$OC_{<i>k</i>}$	Operational criticality score	1 to 5	ISO 14001 and ISO 45001 operational control (ISO, 2015, 2018)
$SR_{<i>k</i>}$	Stakeholder relevance score	1 to 5	GRI 3 stakeholder engagement steps (GRI, 2021); stakeholder salience (Mitchell et al., 1997)
$DA_{<i>k</i>}$	Data availability score	1 to 5	Measurement-system maturity, from this series' verified findings
$KPS_{<i>k</i>}$	KPI Priority Score (equal-weighted mean of the six scores)	1 to 5	Simple additive weighting (Hwang & Yoon, 1981)
$FCI_{<i>k</i>}$	Framework Coverage Index	0 to 1	Share of the four frameworks that address KPI *k* (this paper)
$GRI_{<i>k</i>}$,	Binary coverage indicators	0 or 1	Topic standards of each framework

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$IFRS_{<i>k</i>}$, $BRSR_{<i>k</i>}$, $ESRS_{<i>k</i>}$			(EFRAG, 2023; GRI, 2021; ISSB, 2023a, 2023b; SEBI, 2023)
Tier(·)	Dashboard tier assigned from KPS	1, 2 or 3	Thresholds 4.0 and 3.0 derived from the one-to-five scale (Results)
$Margin_{<i>k</i>}$	Distance from KPS to the nearer tier threshold	Score points (≥ 0)	This paper
$KPS_{alt,<i>k</i>}$	Double-materiality-weighted score	1 to 5	Weights 0.30, 0.30, 0.10, 0.10, 0.10, 0.10 (stress test, this paper)
r	Pearson correlation of KPS and KPS_{alt}	−1 to +1	Pearson (1895)
ρ_s, D, n	Spearman rank correlation; rank difference of a KPI; number of KPIs ranked	−1 to +1; integer; n = 8	Spearman (1904)
$PDG_{<i>k</i>}$	Priority-Disclosure Gap (positive: disclosure trails priority)	Fraction of the maximum	This paper
$Completeness_{<i>k</i>}$	Panel-mean disclosure completeness	0 to 1	Environmental and Safety Completeness Indices of the companion ESG-EHS study

Reading the Equations in Practice

Equation 1. A KPS of 4.17 for occupational safety says that, across six judgements, the KPI sits about 1.2 points above the scale midpoint of 3. Because the mean divides by six, a one-point change in any single criterion moves KPS by exactly 1/6 = 0.17. A safety manager who disputes one score can see at once that the tier does not change (4.17 falls to 4.00, still Tier 1), whereas the same change would move waste (3.00) from Tier 2 to Tier 3.

Equation 2. A KPI covered by GRI, BRSR and ESRS but not IFRS S1/S2 has FCI = 3/4 = 0.75. For a company reporting under BRSR in India whose customers report under ESRS, a KPI with FCI = 1 can be measured once and reused across several reports, which is why coverage is a prioritisation criterion and not only a compliance check.

Equations 3 to 6. The tier rule turns a score into an operating instruction: continuous or monthly monitoring at or above 4.0, quarterly between 3.0 and 4.0, annual review below 3.0. The Margin shows how much confidence the instruction deserves. A margin above 1/6 means that no single one-point re-scoring can change the tier; at 1/6 or less (waste, energy, anti-corruption, occupational safety) a one-point re-scoring can bring the KPI to or across the threshold, and does change the tier for the first three, so those placements are provisional.

Equations 7 to 10. Equation 7 shows how the ranking would look to an organisation that cared mostly about double materiality. A Pearson coefficient near 1 means the two score sets are almost proportional; a Spearman coefficient near 1 means the orderings are almost identical (0.97 on eight KPIs is little more than one adjacent swap), so both are descriptive, not tests of significance. A PDG of 0.15 means that disclosed completeness is 15 percentage points below the level implied by priority; a high priority with a positive PDG is the signal to look for the specific missing disclosure item.

Data Extraction and Scoring Protocol

Each criterion score was assigned through systematic review of the relevant standard's own text, ESRS 1 for ImM and FM, the four frameworks' own topic standards for RR, ISO 14001 and 45001 clause text for OC, GRI 3's stakeholder-engagement guidance for SR, and this series' own previously published, independently verified extraction findings for DA, consistent with the documented three-step protocol, targeted passage location, verbatim extraction and cross-check, established throughout this series. Where this series' companion studies

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had already verified a specific finding, UltraTech's and JSW's explicit double-materiality terminology, or the safety-completeness and environmental-completeness panel means used in validation, those established findings were reused directly rather than re-extracted. The scores were assigned by the author; no second-scorer reliability check was performed, a limitation noted in the Discussion. Company-level evidence on framework use and disclosure was taken from the panel companies' business responsibility and integrated annual reports (for example, Tata Steel Limited, 2026; Tata Motors Commercial Vehicles Limited, 2026; UltraTech Cement Limited, 2026).

RESULTS

The Six-Criteria Scoring Matrix

Table 2 reports the full six-criteria scoring matrix for all eight KPIs, and Figure 2 presents the identical matrix as a scoring grid. Rows are KPIs, columns are the six criteria, and each cell is an integer score from 1 to 5.

Table 2: Six-criteria scores by KPI (1-5 scale)

KPI	ImM	FM	RR	OC	SR	DA
GHG Emissions	5	5	5	5	5	5
Water	4	3	4	4	3	4
Waste	3	2	3	3	3	4
Energy	3	4	4	4	3	5
Occupational Safety	5	3	3	5	5	4
Employee Diversity	2	2	3	2	3	3
Anti-Corruption	2	4	3	2	3	3
Community Impact	3	2	2	2	4	2

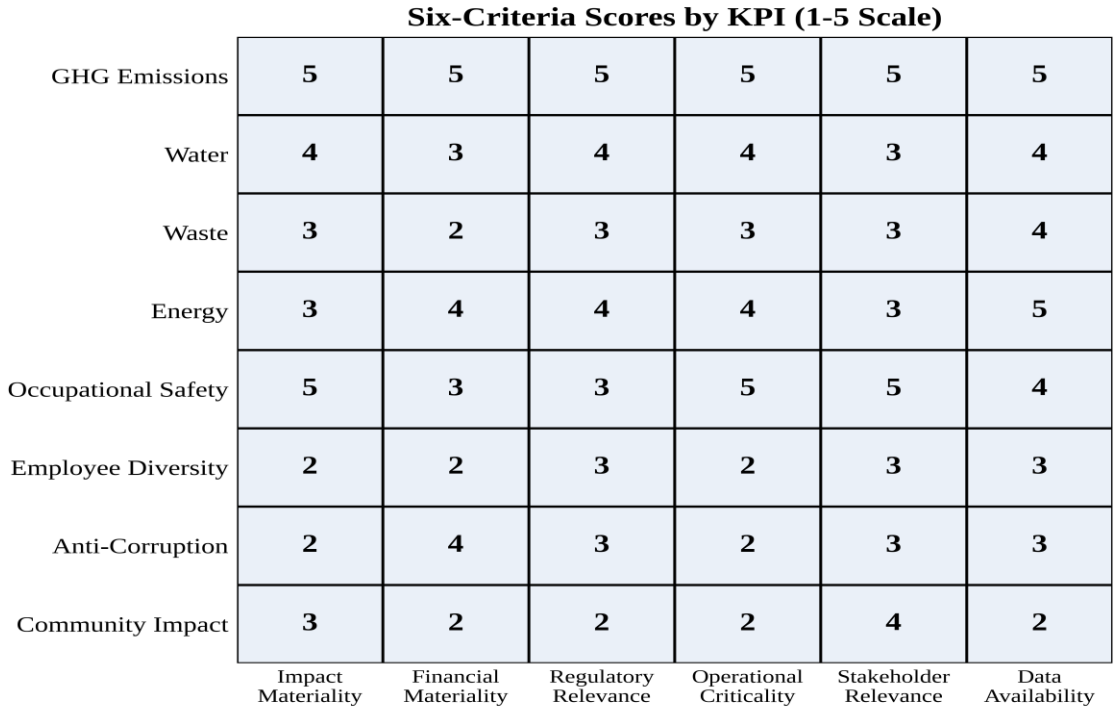


Figure 2: Six-criteria scores by KPI

Greenhouse gas emissions is the only KPI scoring the maximum of 5 on every single criterion simultaneously. Occupational safety shows the widest internal spread of any KPI, scoring the maximum 5 on Impact

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Materiality, Operational Criticality and Stakeholder Relevance while scoring only 3, the panel median, on Financial Materiality and Regulatory Relevance, a profile the Discussion section examines directly.

By column, the mean score is highest for Data Availability (3.75) and lowest for Financial Materiality (3.12). No KPI scores 1 on any criterion, and every score of 2 falls in four KPIs: Waste (FM), Employee Diversity (ImM, FM, OC), Anti-Corruption (ImM, OC) and Community Impact (FM, RR, OC, DA). The four environmental KPIs average 4.00 on Regulatory Relevance and 4.50 on Data Availability, against 2.75 and 3.00 for the four social and governance KPIs; occupational safety is the social exception, with three maximum scores.

The KPI Priority Score, Ranked

Table 3 reports KPS from Equation 1 for each KPI, and Figure 3 plots the full ranking. Table 3 also reports each KPI's Tier Margin from Equation 6.

Table 3: KPI Priority Score, ranked, with dashboard tier

KPI	KPS	Tier	Margin
GHG Emissions	5.00	Tier 1	1.00
Occupational Safety	4.17	Tier 1	0.17
Energy	3.83	Tier 2	0.17
Water	3.67	Tier 2	0.33
Waste	3.00	Tier 2	0.00
Anti-Corruption	2.83	Tier 3	0.17
Employee Diversity	2.50	Tier 3	0.50
Community Impact	2.50	Tier 3	0.50

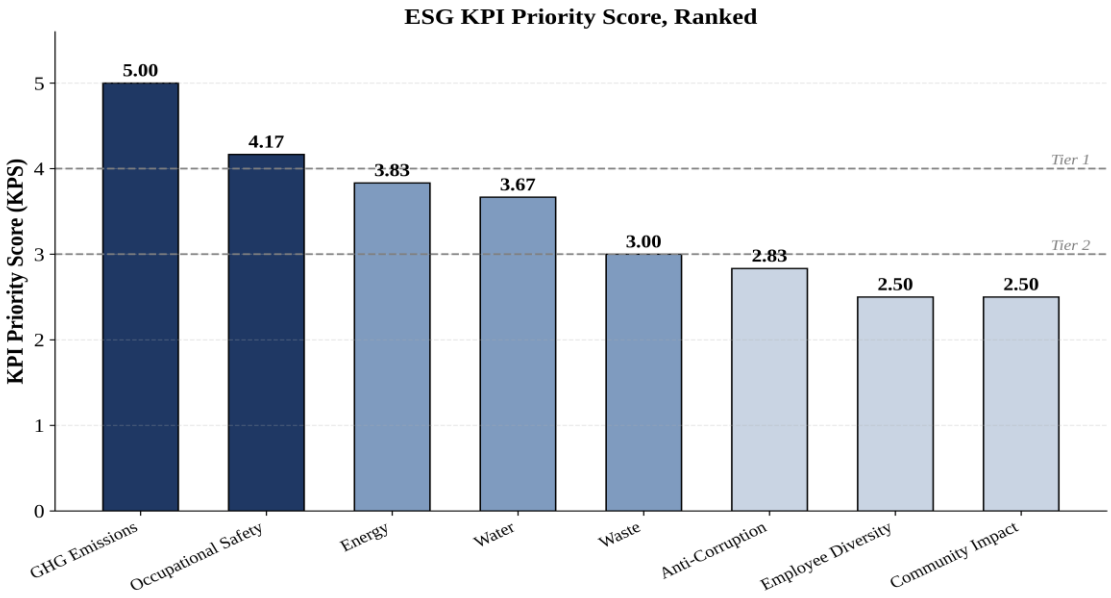


Figure 3: ESG KPI priority score, ranked

Figure 3 plots the scores as bars in rank order, shaded by tier, with dashed lines at the 4.0 and 3.0 thresholds. Greenhouse gas emissions is the only bar at the scale maximum, occupational safety clears the Tier 1 line by 0.17, and waste sits on the Tier 2 line. The Tier Margin in Table 3 makes this explicit: 1.00 for greenhouse gas emissions, 0.00 for waste, and 0.17 for energy, occupational safety and anti-corruption, equal to the effect of changing one criterion by one point (1/6). A one-point change in one criterion would therefore move only

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waste (down to Tier 3), energy (up to Tier 1) and anti-corruption (up to Tier 2); occupational safety would stay in Tier 1 at exactly 4.00. These three placements are provisional.

Equations 3 through 5's specific threshold values, 4.0 and 3.0, are not arbitrary round numbers chosen for convenience; they follow directly from the one-to-five scale each of the six criteria itself uses. A KPI scoring the scale's midpoint, 3, on every criterion simultaneously produces a KPS of exactly 3.0 by construction, Equation 1's own arithmetic, making 3.0 the natural floor for any KPI whose evidence base is, on average, more favourable than a bare midpoint judgement across all six criteria. The 4.0 threshold, similarly, is the KPS a KPI achieves if it scores the maximum of 5 on half its criteria and the midpoint of 3 on the remaining half, a natural description of a KPI with a genuinely strong case on some dimensions without requiring uniform maximum scores across all six, close to occupational safety's own profile in Table 2. This scale-derived logic, rather than an external convention borrowed from unrelated rating systems, is what gives Equations 3 through 5's specific cut points their justification.

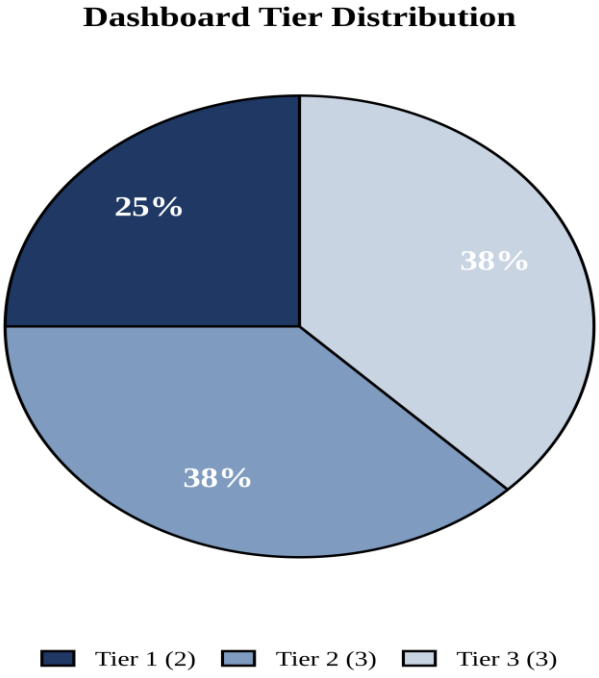


Figure 4: Dashboard tier distribution

The three-tier hierarchy this study's objectives called for splits the eight candidate KPIs 2-3-3: greenhouse gas emissions and occupational safety reach Tier 1, energy, water and waste form Tier 2, and employee diversity, anti-corruption and community impact form Tier 3. The gap between Tier 1's lowest score, 4.17, and Tier 2's highest, 3.83, is 0.33 points, wider than the 0.17-point gap separating Tier 2's lowest score, Waste at 3.00, from Tier 3's highest, Anti-Corruption at 2.83, indicating the boundary separating genuinely high-priority KPIs from the moderate tier is the more decisive break in this panel's data, while the moderate-to-low-priority boundary is comparatively closer and, as the robustness check below shows directly, more sensitive to the specific weighting applied. Figure 4 shows the same classification as shares of the eight KPIs: 25% (two KPIs) in Tier 1 and 37.5% (three KPIs each, labelled 38%) in Tiers 2 and 3. H1 is therefore supported: the scores span 2.50 to 5.00, a range of 2.50 points, and all three tiers are populated.

Robustness Under Double-Materiality Weighting

Table 4 reports KPS under Equation 7's alternative weighting against the equal-weighted ranking from Table 3, and Figure 5 plots both side by side.

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Table 4: Equal-weighted versus double-materiality-weighted KPS and rank

KPI	Equal KPS	Equal Rank	Alt KPS	Alt Rank
GHG Emissions	5.00	1	5.00	1
Occupational Safety	4.17	2	4.10	2
Energy	3.83	3	3.70	3
Water	3.67	4	3.60	4
Anti-Corruption	2.83	6	2.90	5
Waste	3.00	5	2.80	6
Community Impact	2.50	7	2.50	7
Employee Diversity	2.50	7	2.30	8

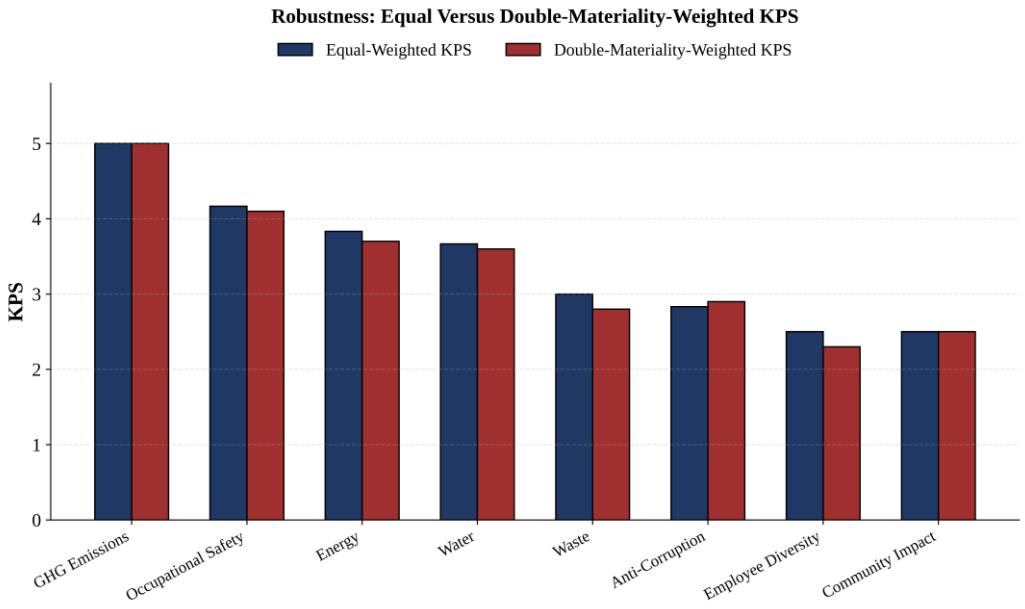


Figure 5: Equal versus double-materiality-weighted KPS

In Figure 5 each KPI has a pair of bars, blue for the equal-weighted and red for the double-materiality-weighted score. The red bar is lower for five KPIs (by 0.20 for waste and employee diversity, 0.13 or less for energy, water and occupational safety), equal for greenhouse gas emissions and community impact, and higher only for anti-corruption (by 0.07).

The top four ranks, greenhouse gas emissions, occupational safety, energy and water, are identical under both weightings, confirming the Tier 1 and the upper half of Tier 2 are robust to raising the combined weight on impact and financial materiality from one third to 0.60. Below that point the ranking does shift: anti-corruption rises from rank 6 to rank 5, overtaking waste. The reordering is mechanical: shifting weight to the two core criteria raises a KPI's score if, and only if, its mean on ImM and FM exceeds its mean on the other four. That holds only for anti-corruption (3.00 against 2.75); the means are equal for greenhouse gas emissions and community impact, and lower for the other five.

Equations 8 and 9 give $r = 0.99$ and $\rho_s = 0.97$ ($n = 8$; mean ranks for the Employee Diversity and Community Impact tie). H2 is therefore supported: the top four ranks and Tier 1 membership are unchanged. Tier membership is not unchanged throughout: under Equation 7 Waste falls to 2.80, below 3.0, and moves from Tier 2 to Tier 3, as its zero margin foreshadowed, so the tier counts become 2-2-4. Energy (3.70) and Water (3.60) stay in Tier 2, and Anti-Corruption (2.90) stays in Tier 3 although it overtakes Waste.

Because RR is not a strict rescaling of FCI, a second check replaced RR by $1 + 4 \times$ FCI. The rank order is unchanged ($\rho_s = 1.00$) and Tier 1 is unchanged, but two KPIs sitting exactly on a threshold move: Energy rises

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to 4.00 (Tier 1) and Anti-Corruption to 3.00 (Tier 2). KPIs on or next to a threshold should be treated as provisional.

Relative Influence of the Six Criteria

Table 5 shows which criterion most influences the outcome in this panel: how widely each criterion varies across the eight KPIs (standard deviation), how closely it moves with KPS (Pearson correlation), and how much the ranking and tiers change if it is omitted and KPS is recomputed as the mean of the other five.

Table 5: Influence of each criterion on KPS across the eight KPIs

Criterion	Mean	SD	*r* with KPS	ρ_s with KPS when omitted	Tier changes when omitted
Impact Materiality (ImM)	3.38	1.19	0.86	0.982	Energy to Tier 1; Anti-Corruption to Tier 2
Financial Materiality (FM)	3.12	1.13	0.75	0.976	None
Regulatory Relevance (RR)	3.38	0.92	0.82	0.994	None
Operational Criticality (OC)	3.38	1.30	0.95	0.994	Anti-Corruption to Tier 2
Stakeholder Relevance (SR)	3.62	0.92	0.64	0.988	Energy to Tier 1
Data Availability (DA)	3.75	1.04	0.84	0.982	Waste to Tier 3

SD is the sample standard deviation across the eight KPIs; *r* is the Pearson correlation of the criterion with the full six-criterion KPS; ρ_s uses mean ranks for ties.

Operational Criticality varies most (SD 1.30) and tracks KPS most closely ($r = 0.95$); Stakeholder Relevance is the weakest link ($r = 0.64$). Omitting Financial Materiality changes the rank order most ($\rho_s = 0.976$), although no tier changes, whereas omitting Data Availability moves Waste, already on the threshold. Greenhouse gas emissions and occupational safety stay in Tier 1 whichever single criterion is omitted, and Energy joins them when ImM or SR is omitted. No single criterion therefore determines the Tier 1 result. These statistics describe these eight KPIs; they are not estimates of the importance of the criteria to any organisation.

Regulatory Framework Presence

Figure 6 reports which of the four frameworks substantively address each KPI, the specific basis for each KPI's Regulatory Relevance score in Table 2.

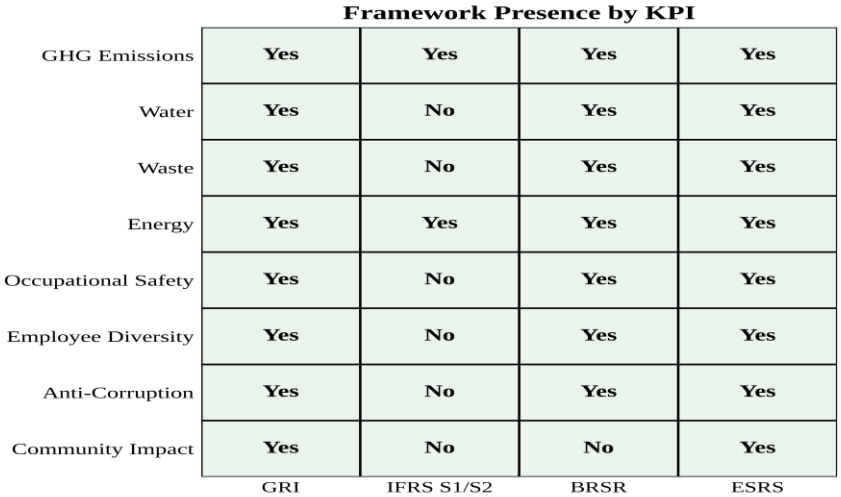


Figure 6: Framework presence by KPI

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Each row of Figure 6 is a KPI and each column a framework; "Yes" marks substantive coverage. Equation 2 gives FCI = 1.00 for greenhouse gas emissions and energy, 0.75 for water, waste, occupational safety, employee diversity and anti-corruption, and 0.50 for community impact.

Greenhouse gas emissions and energy are the only two KPIs present in all four frameworks without exception, IFRS S2's explicit climate focus giving both a regulatory-relevance basis the remaining six KPIs lack, since IFRS S1 and S2 together address occupational safety, diversity and anti-corruption only indirectly, as general sustainability-related financial risk, rather than through a topic-specific standard comparable to IFRS S2's climate focus. Community impact is the only KPI absent from BRSR specifically, consistent with BRSR's Essential Indicators placing comparatively less emphasis on community-level social impact than GRI 413 (GRI, 2016) or ESRS S3 each independently do.

Validation Against Disclosed Practice

For the two Tier 1 KPIs, greenhouse gas emissions and occupational safety, this series' companion ESG-EHS integration study already provides independently verified, panel-wide disclosure-completeness figures, Environmental Completeness Index and Safety Completeness Index panel means of 88% and 68% respectively. Figure 7 plots these alongside each KPI's own KPS, rescaled to a comparable 0-100 basis, testing directly whether this framework's priority ranking is matched by actual disclosure completeness in practice.

This validation strategy follows the logic of data triangulation as Denzin's (1978) foundational methodological taxonomy defines it, examining whether a finding derived from one data source and method converges with a finding derived independently from a different source and method applied to the same underlying phenomenon.

The companion study's SCI and ECI figures were extracted through a document-level disclosure-completeness protocol applied to each company's own BRSR and annual report text, entirely independent of this paper's own criterion-scoring protocol, which draws instead on ESRS, GRI, IFRS and ISO standard text directly.

Agreement between two such independently derived measures, as reported below for greenhouse gas emissions specifically, is methodologically stronger evidence than either measure could supply on its own, precisely because the two protocols share no common source of systematic error that could produce spurious agreement; disagreement, as the same comparison reveals for occupational safety, is correspondingly more diagnostic than a single study's own internal inconsistency would be, since it cannot be attributed to a flaw shared by both measurements.

To make this comparison precise rather than only visual, a Priority-Disclosure Gap places KPS and disclosure completeness on the same normalised 0-to-1 scale and takes their difference directly:

$$PDG_k = \frac{KPS_k}{5} - Completeness_k \quad (10)$$

where $PDG_{<i>k</i>}$ is the Priority-Disclosure Gap of KPI k, $KPS_{<i>k</i>}/5$ is the score as a fraction of its maximum of 5, and $Completeness_{<i>k</i>}$ is the panel-mean disclosure completeness as a fraction (the Environmental Completeness Index for greenhouse gas emissions, the Safety Completeness Index for occupational safety, both from this series' companion study).

A positive PDG indicates a KPI's priority score outruns its disclosed completeness, exactly the gap this study's problem statement identifies as a risk-management concern; a PDG near zero indicates priority and disclosed practice are already well aligned. Figure 7 and the discussion below report PDG for both validated KPIs directly.

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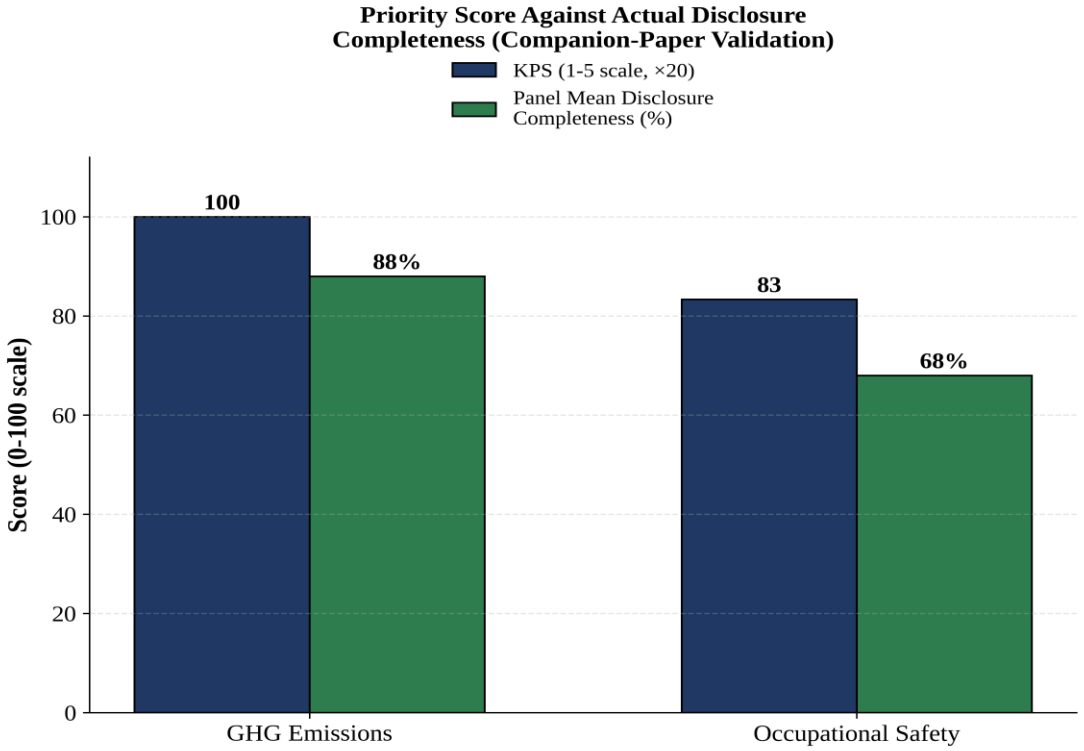


Figure 7: Priority score against disclosed completeness, companion-paper validation

In Figure 7 the blue bar is each KPI's KPS multiplied by 20 (100 and 83) and the green bar is the panel-mean disclosure completeness (88% and 68%); the gap between each pair is the PDG in percentage points.

Equation 10 gives PDG = 5.00/5 − 0.88 = +0.12 for greenhouse gas emissions and 4.17/5 − 0.68 = +0.15 for occupational safety. Disclosed completeness therefore trails priority for both Tier 1 KPIs, and the shortfall is larger for occupational safety, so H3 is supported, although the difference (0.03) is small and should not be over-read. Greenhouse gas emissions pairs the panel's maximum KPS, 5.00, with the highest completeness among the companion study's domains, 88%. Occupational safety pairs a KPS of 4.17, comfortably within Tier 1, with a markedly lower 68%, specifically the companion study's finding that four of five companies in this panel omit a separately computed fatality rate despite disclosing a fatality count. Relative to the completeness its priority implies, occupational safety achieves 82% (0.68/0.83) against 88% for greenhouse gas emissions. This is the kind of gap the problem statement identifies, between an indicator's priority and the attention it receives. Two cautions apply: the completeness figures are domain-level indices used as proxies for individual KPIs, and two KPIs cannot support a statistical test.

DISCUSSION

Why GHG and Safety Lead

Greenhouse gas emissions' perfect score across all six criteria is not an artefact of this framework's construction; it reflects a genuine convergence of independent evidentiary streams, ESRS's own formal double-materiality test, IFRS S2's dedicated climate standard, BRSR Core's mandatory assurance scope, and this series' companion studies' own finding that greenhouse gas emissions consistently shows this panel's most mature and complete disclosure practice across multiple separate empirical tests. Occupational safety's Tier 1 placement rests on a narrower but still decisive basis, the maximum possible score on the three criteria most directly tied to human welfare and operational control, Impact Materiality, Operational Criticality and Stakeholder Relevance, outweighing its comparatively moderate Financial Materiality and Regulatory Relevance scores, themselves a direct consequence of ISSB's climate-specific rather than general safety-specific standard architecture.

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The Anti-Corruption Reordering as a Diagnostic

Anti-corruption's rank improvement under double-materiality weighting is itself diagnostically useful rather than merely a robustness-check curiosity. A KPI whose priority ranking rises when the two double-materiality criteria are weighted more heavily, driven by a financial-materiality score two points above its impact-materiality score, while its ranking under operational and regulatory criteria remains comparatively weak, is a KPI whose materiality case an organisation should expect to strengthen as financial markets and credit-rating processes increasingly price governance and legal risk directly, exactly the forward-looking use multi-criteria weighting sensitivity can serve beyond simply confirming a single, static ranking.

Interpreting the Validation Gap

Occupational safety's validation gap, high priority score against comparatively lower disclosure completeness, connects directly to this series' companion ESG-EHS study's own practical implementation architecture, which identifies the specific missing indicator, a separately computed fatality rate, and the specific operational source already available to supply it, incident records already retained under ISO 45001 Clause 10.2. This framework's contribution is to show that this specific gap is not merely a disclosure-completeness curiosity but sits within the panel's single highest-priority non-environmental KPI, raising its practical stakes directly: closing this specific gap would align disclosed practice with genuine priority more than closing an equivalent completeness gap in a lower-tier KPI would.

A Practical Dashboard Architecture

Directly addressing this study's final objective, Table 6 sets out the practical monitoring cadence and escalation structure this framework's three-tier hierarchy implies for an industrial organisation's internal ESG dashboard.

Table 6: Practical dashboard architecture by tier

Tier	KPIs	Monitoring Cadence	Escalation
Tier 1	GHG Emissions, Occupational Safety	Continuous or monthly operational monitoring	Board-level reporting; external assurance
Tier 2	Energy, Water, Waste	Quarterly operational monitoring	Senior management review
Tier 3	Anti-Corruption, Employee Diversity, Community Impact	Annual review, aligned to reporting cycle	Functional-level ownership

This cadence structure follows directly from each tier's own composition rather than from convention: Tier 1's board-level escalation and external-assurance expectation matches both KPIs' maximum Stakeholder Relevance scores (5) and, for greenhouse gas emissions, its maximum Regulatory Relevance score, while Tier 3's functional-level ownership matches its KPIs' comparatively low Operational Criticality scores, indicating these matters, while still worth monitoring, do not require the same continuous operational integration Tier 1's KPIs do.

Implementation is multidisciplinary. Scoring the criteria draws on sustainability reporting, environmental and safety management, finance and risk, operations, legal and compliance, and data systems. A cross-functional group that scores jointly, rather than a single analyst, reduces individual bias and gives every KPI an owner; the same breadth is needed in a research team extending the framework.

Worked Example: Tracing Occupational Safety's Priority Score

Tracing occupational safety's KPS through Equation 1 directly illustrates how this framework's internal spread, noted above, resolves into a single tier placement. Occupational safety's six criterion scores are ImM=5, FM=3, RR=3, OC=5, SR=5, DA=4:

$$KPS_{Safety} = \frac{5+3+3+5+5+4}{6} = 4.17 \quad (11)$$

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The three maximum scores, Impact Materiality, Operational Criticality and Stakeholder Relevance, each reflecting occupational safety's direct bearing on human welfare and its central place within ISO 45001's own operational control clauses, are sufficient on their own to carry the KPS above the Tier 1 threshold of 4.0 despite the two below-average scores on Financial Materiality and Regulatory Relevance pulling the mean down from a possible maximum of 5.00. This arithmetic transparency, every tier placement traceable to specific, named criterion scores rather than to an opaque composite judgement, is precisely the property Saaty's multi-criteria tradition identifies as the central advantage of a structured, hierarchical scoring method over an unstructured materiality judgement call.

Comparison with the Companion ESG-EHS Framework's Own Criteria

This paper's Operational Criticality criterion deliberately reuses, rather than re-derives, the ISO 14001 and 45001 clause mapping this series' companion ESG-EHS integration study already establishes, a methodological choice worth making explicit. That companion study's own Safety Completeness Index and Environmental Completeness Index measure a conceptually distinct question, how completely a KPI already disclosed is reported against a specific standard's sub-requirements, from this paper's KPS, which measures whether a KPI should be prioritised for monitoring attention in the first place. The two measures are complementary rather than redundant: Table 3's priority ranking identifies occupational safety as a KPI warranting the highest monitoring attention, while the companion study's SCI identifies specifically which sub-requirement, fatality rate, that attention should target first, a sequencing from “what to prioritise” to “what specifically to fix” that mirrors Saaty's own hierarchy descending from general criteria to specific, actionable detail.

Organisational Variation and the Relative Weight of the Determinants of Materiality

Organisations do not share one perspective on materiality. The determinants commonly named (impact significance, financial materiality, organisational relevance, operational importance, stakeholder interests and data availability) enter this framework as shown in Table 7, with the reason each varies between organisations; the evidence on their influence in this panel is in Table 5.

Table 7: Determinants of materiality, their place in the framework and their variation across organisations

Determinant	Criterion	Why it differs between organisations
Impact significance	ImM	Sector footprint, scale and geography of operations
Financial materiality	FM	Capital intensity, exposure to carbon pricing and liability regimes, cost of capital
Organisational relevance (regulatory and strategic)	RR (regulatory part only)	Jurisdiction, listing venue and business model; strategic fit is not scored
Operational importance	OC	Management-system maturity and process hazards
Stakeholder interests	SR	Salience of stakeholders by power, legitimacy and urgency (Mitchell et al., 1997)
Data availability	DA	Measurement-system maturity, supplier base and IT capability

Three senses of “weight” should be kept apart. As nominal weight, each criterion carries 1/6 in Equation 1 and ImM and FM carry 0.30 each in Equation 7; both are modelling choices, not findings. As statistical influence in this panel, Operational Criticality is strongest (Table 5), but no criterion alone decides Tier 1. As normative weight in the standards, impact and financial materiality come first: under ESRS 1 a matter is material if it meets either threshold (EFRAG, 2023), whereas Data Availability is a feasibility modifier, not a materiality criterion. Because the determinants vary, an organisation should elicit its own weights, for example by pairwise comparison (Saaty, 1980), and report equal-weighted and double-materiality-weighted results together as a sensitivity band.

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Conceptual and Philosophical Interpretation

Measurement and meaning. The criterion scores are ordinal judgements, and averaging them as Equation 1 does assumes equal steps between scores, a convention that measurement theory treats with caution (Stevens, 1946). KPS is therefore a device for ordering and grouping KPIs, not a quantity with units; the framework reports a rank statistic next to the Pearson coefficient and states the Tier Margin so that a reader can see how little change would move a KPI across a threshold.

Prioritisation as bounded rationality. Decision makers with limited attention search for satisfactory choices rather than optimising over every option (Simon, 1955). A tiered dashboard is an institutional form of this behaviour, and because criteria and scores are written down it exposes the choice to challenge by boards, assurers and stakeholders instead of leaving it implicit in habit.

Two questions behind double materiality. Impact materiality asks what the organisation does to people and the environment; financial materiality asks what sustainability matters do to the organisation. Occupational safety shows the difference: 5 on impact but 3 on financial materiality, so a framework ranking by financial exposure alone would understate it; anti-corruption shows the reverse (4 on financial, 2 on impact). Stakeholder theory justifies keeping both questions: an organisation owes attention to those it affects as well as to those who finance it (Freeman, 1984), and which affected parties demand attention depends on their power, legitimacy and urgency (Mitchell et al., 1997).

Real-world context. In a steel or cement plant the greenhouse gas KPI is at once the largest environmental impact, a direct exposure to carbon-related cost and investor scrutiny, a regulated and assured disclosure, and a quantity the plant already measures, hence 5 on all six criteria. Occupational safety differs: injuries are severe human impacts, central to the plant's ISO 45001 system, yet IFRS S1 and S2 address them only indirectly, so financial and regulatory scores are lower and disclosure trails priority. Community impact scores low because its data availability and regulatory coverage are weak (both 2), not because communities do not matter: a low tier is a statement about monitoring intensity under limited resources, never about moral importance.

Economic Sustainability and a Practical Guide for Stakeholders

Economic sustainability is treated here as keeping ESG monitoring affordable and value-adding by matching effort to the value of the information produced. Three channels link the framework to this aim. Cost: Data Availability, an ordinal proxy for measurement-system maturity, shows where continuous monitoring is cheap (energy and greenhouse gas emissions, both 5) and where it needs new systems (community impact, 2). Value at stake:

Financial Materiality indicates the exposure that monitoring protects; credible disclosure can lower the cost of equity capital (Dhaliwal et al., 2011), and acting on material issues can create economic value (Porter & Kramer, 2011). Duplication: a KPI with a high Framework Coverage Index can be measured once and reported several times. The study has no monetary data, so Table 8 is a decision aid built from ordinal scores, not a cost-benefit analysis.

Table 8: Economic-sustainability guide by tier

Tier and KPI (KPS; DA; FM)	Economic logic	Practical guidance
Tier 1: Greenhouse gas emissions (5.00; 5; 5)	Highest value at stake, lowest data barrier	Fund first; monthly monitoring, board reporting, external assurance
Tier 1: Occupational safety (4.17; 4; 3)	High priority, good data readiness; the gap can be closed from records already kept	Disclose a separate fatality rate from ISO 45001 incident records; no new system
Tier 2: Energy (3.83; 5; 4)	Cheap to measure, real financial exposure; on the edge of Tier 1	Quarterly review; first candidate for promotion

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Tier 2: Water (3.67; 4; 3) and Waste (3.00; 4; 2)	Moderate value and cost; waste is on the Tier 2 threshold	Quarterly monitoring from existing data; re-score waste annually
Tier 3: Anti-corruption (2.83; 3; 4)	Low monitoring cost, high exposure through legal liability	Annual review with compliance-grade controls; escalate if exposure rises
Tier 3: Employee diversity (2.50; 3; 2) and Community impact (2.50; 2; 2)	Low value at stake; community data are costly	Annual review, functional ownership; no bespoke data system unless required

For stakeholders: management and finance can allocate monitoring budgets in tier order; boards and audit committees can reserve attention and assurance for Tier 1; investors and lenders can use the PDG as a due-diligence question; and standard-setters can note that IFRS S1 and S2 address occupational safety only indirectly. A mandatory disclosure remains mandatory in every tier. A cost-benefit model would need, per KPI, annual monitoring cost, estimated avoided loss or revenue effect and any cost-of-capital effect, which are left to future research.

LIMITATIONS

1. Eight KPIs is a representative but not exhaustive candidate set; a full industrial ESG indicator universe, spanning every GRI, IFRS, BRSR and ESRS topic standard simultaneously, would run to several dozen indicators this screening-level study did not attempt to score individually.
2. All six criteria are scored on the same one-to-five scale and combined with equal weight in Equation 1; this mirrors the unweighted construction used elsewhere in this series, with Equation 7's alternative weighting offered specifically as a sensitivity check rather than as a claim that double-materiality weighting is the objectively correct choice.
3. Validation against disclosed practice was possible only for the two KPIs, GHG emissions and occupational safety, this series' companion studies had independently scored; the remaining six KPIs' priority rankings have not yet been tested against comparably verified disclosure-completeness data.
4. This framework was applied to a single five-company Indian industrial panel; whether the same six criteria would produce a materially different tier structure for organisations in other sectors or regulatory jurisdictions has not been tested.
5. The criterion scores are ordinal judgements assigned by the author from the documented sources, without a second scorer or an inter-rater reliability check, and Equation 1 treats the steps between scores as equal.
6. Regulatory Relevance is anchored on, but is not a strict rescaling of, the Framework Coverage Index, so KPIs on a tier threshold (Waste, Energy, Anti-Corruption) are sensitive to small scoring changes.
7. The validation uses domain-level completeness indices as proxies for individual KPIs, expresses KPS as a fraction of its maximum of 5 (mapping the 1 to 5 scale onto 0.2 to 1.0), and covers only two KPIs, so H3 is tested descriptively.
8. The economic-sustainability guide is built from ordinal scores and contains no monetary cost, benefit or cost-of-capital data.

Future Research Directions

1. Extending this framework to a full industrial ESG indicator universe, scoring several dozen candidate KPIs rather than eight, would test whether the sharp Tier 1-to-Tier 2 break identified here persists at greater indicator density.
2. Constructing comparable disclosure-completeness indices for the six KPIs this paper could not validate against independently verified data, energy, water and waste in particular, given this series' companion studies' existing environmental-domain extraction, would complete the validation this paper performs only partially.

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3. Applying this same six-criteria methodology to organisations outside this series' established panel would test whether the specific tier assignments found here, rather than the methodology itself, generalise beyond Indian heavy industry.
4. Eliciting criterion weights from a multidisciplinary panel (sustainability, environment-health-safety, finance, operations, legal and stakeholder specialists) by pairwise comparison, and testing whether weights differ by sector, size and jurisdiction.
5. Adding monetary data on monitoring cost, avoided loss and cost-of-capital effects, so that the economic-sustainability guide becomes a cost-benefit prioritisation.

CONCLUSION

Not every ESG indicator an industrial organisation could monitor deserves equal monitoring attention, yet existing materiality assessments typically identify broad topics rather than individual operational KPIs, and existing framework mappings rarely combine impact materiality, financial materiality, regulatory relevance, operational criticality, stakeholder relevance and data availability into a single, reproducible priority score.

This paper developed that combination, grounding impact and financial materiality directly in ESRS 1's formal double-materiality definition, and applied it to eight candidate KPIs spanning this series' established environmental and social domains, producing a three-tier dashboard hierarchy in which greenhouse gas emissions and occupational safety reach Tier 1, energy, water and waste form Tier 2, and employee diversity, anti-corruption and community impact form Tier 3.

Findings Against the Hypotheses

H1 (discrimination) is supported: KPS ranges from 2.50 to 5.00 and all three tiers are populated (2-3-3). **H2 (robustness)** is supported with a qualification: raising the combined weight on impact and financial materiality to 0.60 leaves the top four ranks and Tier 1 membership unchanged ($r = 0.99$, $\rho_s = 0.97$), but Waste, exactly on the Tier 2 threshold, falls into Tier 3, and under a strict rescaling of Regulatory Relevance Energy and Anti-Corruption each move up one tier. **H3 (priority-disclosure gap)** is supported modestly: disclosed completeness trails priority for both Tier 1 KPIs (PDG = +0.12 for greenhouse gas emissions, +0.15 for occupational safety), with the larger gap for occupational safety; the evidence rests on two KPIs and domain-level proxies, so it is directional rather than statistical. Together these findings answer the problem statement: an organisation can identify, transparently and reproducibly, which KPIs warrant its closest monitoring, and can see where its disclosure lags its priorities.

RECOMMENDATIONS

1. **Adopt the tiered structure.** Monitor Tier 1 continuously or monthly with board reporting and external assurance, Tier 2 quarterly with senior-management review, and Tier 3 annually under functional ownership (Table 6).
2. **Close the occupational safety disclosure gap first.** Disclose a separately calculated fatality rate from the incident records already retained under ISO 45001 Clause 10.2; no new data system is needed.
3. **Treat placements on or near a threshold as provisional.** Re-score Waste, Energy and Anti-Corruption annually and whenever a criterion changes by a point, and report equal-weighted and double-materiality-weighted results together.
4. **Score with a cross-functional team and company data.** Replace the illustrative scores with the organisation's own, elicit weights by pairwise comparison, and document each score's source.
5. **Allocate monitoring effort in tier order.** Use Data Availability as the first proxy of cost (Table 8), record actual costs and avoided losses, and avoid bespoke data systems for Tier 3 unless a regulation or stakeholder requires them. Mandatory disclosures stay mandatory in every tier.
6. **For standard-setters and researchers.** Note that IFRS S1 and S2 address occupational safety only indirectly (Figure 6), publish KPI-level completeness data so that gaps can be tested on more than two KPIs, and extend the framework to the full indicator universe and other sectors.

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Grounded throughout in formally defined standards rather than in criteria of the author's own invention, this framework gives industrial organisations a reproducible method for allocating ESG monitoring and reporting resources according to genuine materiality rather than administrative convenience.

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