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Financial, Double, or Dynamic?
Theories of ESG Materiality and Practitioner Approaches

Charles Dodsworth, Edmund Bourne, and Billie-Louise Schlich

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Financial, Double, or Dynamic?
Theories of ESG Materiality and Practitioner Approaches

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KEY FINDINGS

- Although their labeling and structure may differ, ESG topic lists are relatively similar in their content across standard setters and ESG score providers despite different conceptions of materiality.
- ESG ratings and scores typically claim to consider materiality of ESG issues depending on specific company characteristics. However, standard setters provide companies—and by extension, score providers—with limited practical guidance on determining materiality.
- Proprietary materiality matrixes have been developed by ESG rating and score providers for which detailed methodologies are seldom publicly available. Greater transparency on materiality matrixes and their construction would help stakeholders.

ABSTRACT

The use of ESG ratings and scores has become ubiquitous in asset management, with 9 in 10 European fund managers in a recent survey using them to support their investment process. Meanwhile, these tools have come under sustained criticism, with detractors highlighting methodological divergences, inconsistent predictive power, and inherent biases. By contrast, less attention has been paid to understanding their design, for which there is little academic research. Building on a framework from Berg, Kölbel, and Rigobon (2022), this article focuses on the first step in constructing an ESG score and a key source of divergence among available solutions: scope, in which ESG topics are defined and selected as material for integration into company assessments. The authors first identify two key stages—topic selection and materiality matrix—in the process of defining scope for an ESG scoring model. Next, they survey approaches to these stages as outlined by regulators and standard setters and developed by ESG score providers. Lastly, they propose three avenues to reduce scope divergence across ESG models.

The meteoric rise of ESG scores and ratings[1] leaves the financial industry with a curious dilemma: They are both widely used and widely distrusted. In a recent survey, 9 out of 10 (88%) European fund managers profess to use ESG scores

[1]The International Organization of Securities Commissions (IOSCO) define ESG ratings as referring to "the broad spectrum of ratings products that are marketed as providing an opinion regarding an entity a financial instrument or a product, a company's ESG profile or characteristics or exposure to

(Ninety One 2022). Meanwhile, nearly two in three (63%) respondents in a call for evidence on ESG scores and ratings for the European Securities and Markets Authority (ESMA) (2022) indicate that they are dissatisfied with levels of transparency, alongside other notable concerns including a lack of comparability and misalignment of definitions. In the United States, controversy around ESG investing is growing, with an increasing number of anti-ESG bills filed at the state level (Kerber 2023).

To build an ESG model, providers must grapple with complex decisions, subjectivity, and incomplete information to derive solutions (Kotsantonis and Serafeim 2019) that fit a range of use cases. Models can rely on input data primarily harvested from wide-ranging corporate disclosures[2] but also occasionally include other data sources (such as information on the products and services provided by the company; data collected from news flows; data on fines for ESG infractions). As a result of this diversity, ESG ratings or scores in the market today can look very different from one another.

For support, data providers can look to a limited but fast-expanding literature on ESG ratings and scores that has mostly focused on what useful information can be gleaned from them, particularly in terms of *financial materiality* (for recent surveys of the literature, see Whelan et al. 2021 or Billio et al. 2021). In contrast, rather less attention has been paid to the options or trade-offs involved in ESG rating or score construction.

Berg, Kölbel, and Rigobon (2022) are a notable exception. In their paper, "Aggregate Confusion," they investigate ESG ratings from six providers observing significant divergence in assessment results. As part of their analysis, they usefully summarize many of the steps in building an ESG model into three core segments—scope, measurement, and weight—and use this framework to pinpoint the sources of variance between different ratings, identifying three key elements:

- Scope divergence refers to the situation in which differences in ratings are based on different sets of attributes being assessed.
- Measurement divergence refers to a situation in which rating providers measure the same attribute using different indicators.
- Weight divergence emerges when rating agencies take different views on the relative importance of attributes.

In examining ratings from different providers, "Aggregate Confusion" pinpoints scope divergence as a particularly important source of disagreement in assessment results (contributing 38% to the variation in ratings).

In this article, we expand this line of inquiry to assess how scope can be approached in ESG models, proceeding as follows. We first briefly summarize the conceptual debates on scope and materiality and identify two key stages—topic selection and materiality matrix—in the process of defining scope for an ESG scoring model. Next, we systematically survey approaches to topic selection and materiality

ESG, climatic or environmental risks or impact on society and the environment that are issued using a defined ranking system of rating categories, whether or not these are explicitly labelled as 'ESG ratings'" (IOSCO 2021).

For the purposes of this article, we consider both ESG scores and ratings, denoting a range of assessments—either analyst led or algorithmically driven—that consider environmental, social, and governance issues at corporates and aggregate to a single metric or classification. ESG score providers that primarily use outside-in information on companies such as external news sources (e.g., TruValue Labs, MarketPsych, RepRisk) or assessments focused on specific sustainability topics (such as diversity and inclusion scores or climate transition scores) are outside of the scope of the present assessment.

[2] Ten of the 13 ESG score providers in the most recent Rate the Raters report by the SustainAbility Institute by ERM (2023) use passive sources of information for their primary ESG rating, as opposed to sources such as questionnaires and company engagement.

matrixes as advocated by regulators and standard setters and developed by providers of ESG scores and ratings. Finally, we discuss our findings, considering both the theory and the practical implementation of materiality assessments, and outline some pragmatic approaches to reducing scope divergence.

MATERIALITY AND SCOPE

The guidelines to determine which ESG topics should be considered as relevant—or material—to companies have been subject to extensive debates across standard setters, regulators, practitioners, and academics (Impact Management Project 2020; Serafeim and Yoon 2022; Stocco Betiol and Marzionna 2022). In particular, they have focused on whether materiality should be defined in terms of potential financial impacts (financial materiality)[3] or whether it should encompass the company's impact on the economy, environment, and people (impact materiality).[4]

More recently, financial and impact materiality have been combined under a single theoretical umbrella of *double materiality*[5] (De Cristofaro and Gulluscio 2023), a defining feature of the Exposure Draft of the European Sustainability Reporting Standards developed by the European Financial Reporting Advisory Group (EFRAG). Dynamic materiality—arguing that information is relevant, which incorporates risks that are financially material now, alongside those that are not yet but may become material in the future—has also gained traction recently, having been advocated by the World Economic Forum (WEF) in its white paper "Embracing the New Age of Materiality" (2020a). These materiality debates, however, have remained largely conceptual, and limited attention has been paid to (a) how these materiality debates inform practitioner choices and (b) empirically comparing the topics that different standards or scoring models include.

It is useful here to further define the scope of ESG models into two key aspects. First, a fundamental decision needs to be made about the concrete set of topics (such as climate, water, health and safety, diversity, and corruption) that the assessment will cover.[6] This topic selection is a critical aspect that shapes data inputs and ultimately helps to determine aggregated ESG scores and ratings.

Second—given significant variation in ESG risks affecting different industries and business models—there is broad consensus that not all topics are relevant to assess for each company (e.g., Khan, Serafeim, and Yoon 2015). For example, water use might be a highly relevant ESG issue for a company operating in the mining sector but perhaps less relevant for banking operations. In practice, ESG assessments therefore typically consider a subset of the overall list of ESG topics when assessing specific sectors or companies. The set of rules governing this selection—often described

[3] "Information is material if omitting, misstating or obscuring it could reasonably be expected to influence the decisions that the primary users of general purpose financial statements make on the basis of those financial statements, which provide financial information about a specific reporting entity" (IFRS 2018).

[4] "… matters that reflect actual or potential significant impacts on people and the environment connected to a reporting entity's own operations and its upstream and downstream value chain" (EFRAG 2021).

[5] The double materiality concept originated from the EU Commission's guidelines on nonfinancial reporting (European Commission 2019).

[6] Note that this is separate from the question of how to assess corporate performance on these issues, which is covered as *measurement* by Berg, Kölbel, and Rigobon (2022) and outside of the scope of this analysis.

as a materiality matrix[7]—is therefore equally important to ESG model scope and an important source of divergence among scores and ratings.

CURRENT APPROACHES TO ESG TOPIC SELECTION

To fill the research gap, we systematically survey how different actors approach scope in ESG model construction, focusing on both topic selection and materiality matrixes. Our analysis focuses on a (nonexhaustive) sample for two groups of key actors: regulators and standard setters, and ESG score providers. Although the former group is one step removed from ESG scoring, they set the expectations for corporate reporting on ESG topics and provide an important source of guidance to determine ESG materiality. ESG score providers then synthesize the results of corporate reporting into actionable scores or ratings for investors.

Among regulators and standard setters, we examine the two foremost ESG reporting standards, the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB), as well as the frameworks developed by WEF in its Measuring Stakeholder Capitalism initiative; the Exposure Draft of the European Sustainability Reporting Standards developed by EFRAG; and the Exposure Draft of the International Financial Reporting Standard's (IFRS) Sustainability Disclosure Standard developed by the International Sustainability Standards Board (ISSB). Among ESG score providers we focus on FTSE Russell, Refinitiv, MSCI, Morningstar Sustainalytics, and S&P Global.[8]

We first record the ESG topics that each regulator, standard setter, and ESG score provider covers. We record this information from publicly available sources such as websites or official documentation from those organizations. We define ESG topics at the highest level of aggregation below the environmental, social, and governance level. The results are summarized in Exhibit 1. We find an average of 26.7 topics ranging from 10 topics for Refinitiv to 68 for S&P Global.[9]

We find significant overlap in the topics that each framework covers, despite heterogeneity in terms of how these are named and organized. Publicly available descriptions of how topic lists have been generated are limited; standard setters provide some high-level information on the principles used to select topics (such as their actionability, relevancy across an industry, potential to affect corporate value, consistency across existing frameworks),[10] but there is generally limited public information on the specific implementation of those principles in the standard setters' decision-making processes, with the exception of EFRAG.[11] Similarly, there is little public information available on how topic selection was performed by ESG score providers, aside from high-level descriptions such as internal research. To allow for

[7] Materiality matrixes of one sort or another are used by companies, standard setters, and score providers to determine relevant ESG issues. These take different forms and can be given alternative labels (matrixes, maps, assessments). For discussions on materiality matrixes, see Geldres-Weiss et al. (2021) and De Cristofaro and Raucci (2022).

[8] Topic lists were not publicly available at the time of research for Bloomberg and Institutional Shareholder Services (ISS) and thus have been omitted.

[9] ISSB was excluded because its set of draft standards was not released in full as of May 2023.

[10] Prior to the consolidation of the Value Reporting Foundation into the IFRS Foundation, SASB outlines the high-level principles governing its topic selection, referencing its 2017 Conceptual Framework document. See SASB (2017, 2020a). Likewise, WEF outlines five criteria for its topic selection: "1. Consistency with existing frameworks and standards; 2. Materiality to long-term value creation; 3. Extent of actionability; 4. Universality across industries and business models; 5. Monitoring feasibility of reporting" (WEF 2020b).

[11] Proposals 35–38 in the preparatory work conducted by EFRAG's task force set out considerations for defining a list of ESG topics. These considerations include mention of specific EU policy priorities—for example, the EU taxonomy and the OECD Guidlienes for Multinational Enterprises on Responsible Business Conduct—and how they relate to each of the E, S, and G topics. See EFRAG (2021).

EXHIBIT 1

Breakdown of ESG Topics across Frameworks

	Framework		Number of Topics	ESG Topic Pillar[a]			
				E	S	G	Other
Regulators and Standard Setters	EFRAG[b]	[Draft] European Sustainability Reporting Standards	12	5	3	1	3
	GRI	Universal, Topic and Sector Standards	38[c]	7	15	5	8
	SASB	General Issue Categories	26	8	8	8	2
	WEF	Themes	18	7	4	5	2
	ISSB	[Draft] IFRS Sustainability Disclosure Standard	2	1	–	–	1
ESG Score and Ratings Providers	FTSE Russell	ESG Themes	14	4	4	4	2
	MSCI	ESG Key Issues	33	11	8	7	7
	Refinitiv	Material ESG Issues	10	2	3	4	1
	S&P Global	CSA Criterion	68	20	24	12	12
	Morningstar Sustainalytics	Material ESG Issues and Corporate Governance	21	5	7	5	4

NOTES: Standard setters or regulators that do not provide disclosure standards (ESMA, OECD, and US Securities and Exchange Commission) or are specialized in specific ESG topics (such as the Task Force on Climate-Related Financial Disclosures [TCFD], Carbon Disclosure Project [CDP], or Corporate Human Rights Benchmark) are omitted.

[a]Themes are categorized by ESG topic pillar as per the topics in Exhibit A3 in the appendix. The result of this mapping exercise is shown in Exhibits A4 and A5. See accompanying notes for more details.

[b]We note that EFRAG is an expert group requested by the European Commission to provide technical advice on the draft European Sustainability Reporting Standards (ESRS) (European Commission 2021), rather than a regulator or standard setter itself.

[c]Three of GRI's standards are sector specific, so they do not fall under an ESG topic pillar.

SOURCES: GRI (n.d.), SASB (n.d.), Sustainalytics (n.d.), FTSE Russell (2020), WEF (2020b), EFRAG (2022b), ISSB (2022a, 2022b), Refinitiv (2022), S&P (2022), MSCI (2023).

a more systematic comparison of these topics, we categorize them against 20 high-level ESG topic definitions presented in Exhibit A3 in the appendix, with the outputs presented in Exhibits A4 and A5 in the appendix.

Our analysis shows closest alignment on the scope of environmental topics. Most frameworks, for example, consider carbon emissions, transition risk, and waste and pollution, as well as energy and resource use. There are only a limited number of exceptions to this, such as physical climate risk, which is defined as a standalone topic by SASB but is not separately considered in most other frameworks.

In contrast, differences across ESG frameworks for social topics are the most pronounced, both in terms of the issues covered and the way that they are organized. GRI, for example, has nine standards that are related to different labor topics (spanning from freedom of association and child labor to forced labor issues), while these are covered in one or two themes by EFRAG and FTSE Russell. Meanwhile, most ESG models converge around topics of board oversight and bribery and corruption measures under governance but with less consensus on topics such as data security or tax transparency.

We further find a handful of ESG topics do not neatly fit into precise, mutually exclusive E, S, and G pillars. Diversity and inclusion, for example, is sometimes presented as a standalone social theme (particularly by standard setters) or alternatively is spread across several topics in the S and G pillars. Likewise, supply chain considerations are often integrated in various ways across the E, S and G pillars.

Despite standard setters and score providers in many cases explicitly committing to specific conceptions of materiality (Exhibits A1 and A2), they in practice appear to draw up comparable lists of ESG topics. For instance, although the nomenclature and organization of the EFRAG, GRI, and SASB frameworks differ, each cover every high-level environmental and social topic (Exhibit A4) at least once, irrespective of their stance on financial versus double materiality.

APPROACHES TO MATERIALITY MATRIXES

ESG scores and ratings typically do not consider all ESG topics that are part of an ESG model for all companies that are being assessed, instead considering only the most relevant (or material) topics for a specific company as input. Although there is strong consensus among standard setters and score providers that narrowing the focus of the assessments is necessary and useful in constructing ESG scores and ratings, we find no agreement on how this filtering of topics should occur in practice.

Standard Setters and Regulators

In general, standards setters and regulators have left the task of determining the most relevant ESG topics to companies themselves—counting on company insiders leveraging their deep knowledge of risks facing their organization to self-declare pertinent issues. GRI[12] and EFRAG,[13] for example, publish guidance for companies on conducting a materiality assessment to self-determine material issues (in addition to some universally applied topics) but stop short of prescribing a specific list of issues. A number of other standards (TCFD,[14] WEF,[15] ISSB[16]) also rely on companies to define material issues but generally provide less guidance on how to conduct these assessments.

SASB is the notable exception among standard setters, having developed the Sustainable Industry Classification System (SICS)[17] to prescribe a set of material ESG issues for a typical company within a given industry as part of its SASB sector standards. We note, however, that uptake of this materiality classification among major ESG score providers has nonetheless been slow, perhaps because of requirements for its commercial licensing[18] or difficulty in applying some standards internationally.[19]

[12] GRI includes guidance to help companies establish their material topics within its Universal Standard "GRI 3: Material Topics 2021." GRI maintains a number of sector-specific standards that provide a list of material topics for companies in specific sectors, but these are not available for all sectors. See GRI (2021). Previous iterations of GRI standards (GRI 101: Foundation 2016) contained a materiality matrix for assessing topic materiality (GRI 2016), but this matrix did not prescribe relevant ESG topics for companies and is no longer included in GRI standards (GRI 1: Foundation 2021).

[13] EFRAG outlines an approach to a materiality assessment as part of sections 3.4 and 3.5 of its draft standard "ESRS 1 General Requirements." Note that based on the draft ESRS, companies should be required to disclose the following regardless of their materiality assessments: all disclosure requirements within ESRS2 [draft], datapoints prescribed in topical [draft] ESRS that are listed in [draft] ESRS 2 appendix list of data points in cross-cutting, and [draft] topical standards that are required by EU law, which stem from other EU legislation. See EFRAG (2022b).

[14] TCFD suggests that "Organisations should determine materiality for climate-related metrics consistent with how they determine the materiality of other information included in their financial filings." TCFD recommends that Scope 1 and 2 greenhouse gas emissions be disclosed regardless of a materiality assessment. See TCFD (2021a).

[15] WEF writes that "This project uses the term 'material' to mean information that is important, relevant and/or critical to long-term value creation. […] Materiality is a dynamic concept, in which issues once considered relevant only to social value can rapidly become financially material. […] While we encourage broad adoption of these metrics and their inclusion in mainstream reporting, we understand that companies will apply their own materiality lens to inform what they disclose and what they explain" (WEF 2020b).

[16] ISSB suggests that companies should define material information for themselves: "An entity shall apply judgement to identify material sustainability-related financial information. Materiality judgements shall be reassessed at each reporting date to take account of changed circumstances and assumptions" (ISSB 2022a).

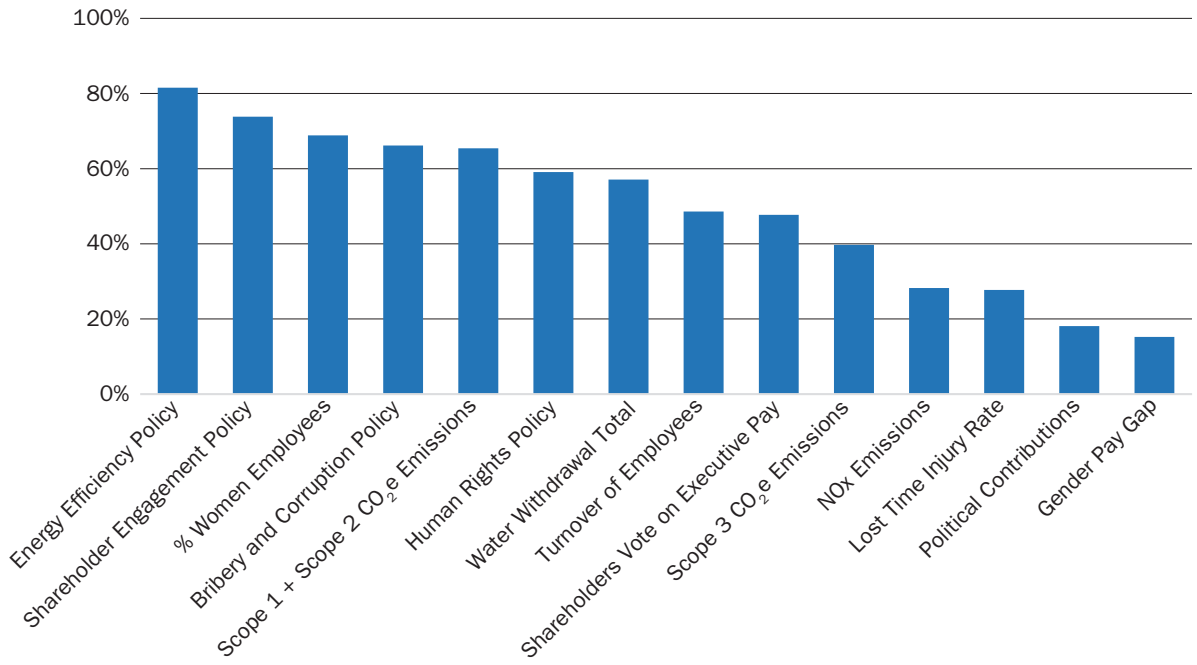
[17] See SASB (2018).

[18] The SASB Framework and SASB SICS classifications have been used by State Street Global Advisors' ESG Solution, which drives several Bloomberg indexes. See Bloomberg (2022).

[19] In a 2023 exposure draft, the ISSB states that "Some of the guidance supporting the SASB Standards metrics currently uses definitions, terminology or references to jurisdiction-specific laws and regulations that can make that guidance difficult to apply in other jurisdictions" (ISSB 2023).

EXHIBIT 2

Disclosure Rates for Selected ESG Data Points in the FTSE All World



SOURCES: FTSE Russell Index data as at December 19, 2022; Refinitiv ESG data as at December 19, 2022.

ESG Ratings and Score Providers

In practice, company disclosures are rarely clear on what ESG topics should be considered material for the business in question. Where salient ESG data and disclosures are missing, outsiders have limited means to assess whether the company has (potentially mistakenly) determined that an ESG topic is not material to its business—or whether it lacks awareness on the issue, is mismanaging it, or worse, is actively trying to avoid scrutiny on the subject.

This ESG data gap is clearly significant. Exhibit 2 shows the disclosure rates for a subset of critical ESG metrics for the FTSE All World, highlighting variations in ESG reporting. This demonstrates how disclosure levels typically are more likely to follow historical or cultural trends as opposed to being highly correlated with ESG materiality.

This creates a significant challenge for providers of ESG ratings and scores. On the one hand, company disclosures don't provide enough reliable data; on the other hand, there is little guidance from standard setters on how companies should determine material topics. As a result, ESG score providers have generally developed their own proprietary materiality matrixes, which can differ significantly from each other and are a key contributor to scope divergence among ESG ratings and scoring models.

Public documentation on the design of these matrixes is generally fairly limited[20] but typically entails grouping companies according to similar industry/sustainability characteristics and then assigning a subset of ESG topics to each of these groupings. Where information is available, providers can present significant differences in terms of the granularity of their materiality groups. For instance,

[20] We note that Refinitiv discloses a detailed indicative ESG materiality matrix and an overview of the methodology driving this matrix as part of Refinitiv's publicly available methodology document. See Refinitiv (2022).

MSCI adopts Global Classification Industry Standard (GICS) subindustries[21] (~160 categories) as a foundation, S&P appears to utilize the GICS industries[22] (~60 categories), and FTSE Russell and Refinitiv use Industry Classification Benchmark (ICB) and the Refinitiv Business Classification (TRBC), respectively. These classifications often serve as initial groupings, upon which further layers such as geographical exposure (e.g., in the FTSE Russell model[23]) and/or more company- or business-model-specific considerations are applied.

There can also be significant differences in how providers of ESG ratings and scores have determined linkages between materiality groupings and ESG topics. In some cases, issues may be considered relevant across all companies, for example, corporate governance in the MSCI[24] and Sustainalytics[25] models and climate change in the FTSE Russell[26] model. Some providers may use empirical data such as the historical correlations of ESG issues to financial impacts (MSCI, S&P, Sustainalytics),[27,28,29] disclosure levels for specific groups, or median performance on particular issues to determine if a topic is relevant to a group (Refinitiv).[30] They may also turn to subject-matter knowledge from industry experts, clients, and other stakeholders to provide input.

Lack of granular reporting on business activities by many companies further complicates materiality assessments and introduces another factor for scope divergence in assessments. Exhibit 3 illustrates this for the reporting of business activities by FAANG companies.[31]

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[21] See MSCI (2023).

[22] See S&P (2023).

[23] See FTSE Russell (2022).

[24] "All companies in all industries are evaluated on the Key Issues under the Governance Pillar, with six governance Key Issues evaluated across two Themes: Corporate Governance and Corporate Behaviour" (MSCI 2023).

[25] "MEIs are subindustry specific, and therefore may appear for some subindustries and not for others. […] Corporate Governance, however, applies to all companies within the ESG Risk Ratings, and the pillars that comprise it do not vary by subindustry" (Sustainalytics 2018).

[26] The climate change theme is applicable across all high-, medium-, and low-impact subsectors. See FTSE Russell (2022).

[27] "We recalibrate the model, including identifying industry Key Issues and setting weights, every year based on the latest data and research as well as input from our regular client consultations" (MSCI n.d.a).

[28] "The financial materiality analysis focuses on industry-specific business value drivers that contribute to company performance. It leverages our quantitative research, which identifies which intangible factors have demonstrated the clearest correlations to past financial performance […] Most importantly however, the materiality analysis draws upon the experience of the industry analysts, who determine which long-term economic, social or environmental factors are likely to have the most significant impact on a company's business value drivers of growth, cost or risk, and ultimately, future financial performance" (S&P 2021).

[29] "Assessments of materiality within the ESG Risk Rating are in part qualitative and require judgement, which has been provided by our experienced sector research teams in a structured and guided process. Some issues are material from an ESG perspective even if the financial consequences are not fully measurable today" (Sustainalytics 2020).

[30] Refinitiv's magnitude matrix is calculated using industry medians ("the relative median values for each industry group to which the data point is material are compared, and decile ranks are assigned") and transparency weights ("the disclosure percentage for each industry group to which the data point is material is identified, and decile ranks are assigned"). See Refinitiv (2022).

[31] FAANG is a commonly used acronym to describe five important companies in the technology sector: Meta Platforms (formerly Facebook); Amazon.com, Inc.; Apple, Inc.; Netflix, Inc.; and Alphabet, Inc. (formerly Google).

EXHIBIT 3

FAANG Companies' Revenue Segment Breakdowns (values in US$ millions) from 2022 Form 10-Ks

	FY 22	Revenue
Meta Platforms, Inc.	Family of apps	114,450
	Reality labs	2,159
	FY 22	**Net Sales**
Amazon.com, Inc.	North America	315,880
	International	118,007
	AWS	80,096
	FY 22	**Net Sales**
Apple, Inc.	Americas	169,658
	Europe	95,118
	Greater China	74,200
	Japan	25,977
	Rest of Asia Pacific	29,375
	iPhone	205,489
	Mac	40,177
	iPad	29,292
	Wearables, Home, and Accessories	41,241
	Services	78,129
	FY 22	**Revenue**
Netflix, Inc.	One operating segment	31,616
	Streaming	31,470
	DVD	146
	FY 22	**Revenue**
Alphabet, Inc.	Google Services	253,528
	Google Cloud	26,280
	Other Bets	1,068
	Hedging gains	1,960

SOURCES: Alphabet, Inc. (2022); Amazon, Inc. (2022); Apple, Inc. (2022); Meta Platforms, Inc. (2022); Netflix, Inc. (2022).

CONCLUSION

In this study, we examined different approaches to scope—a key methodological step common across ESG models that influences nearly 40% of divergence in a company's final score or rating. We focus on two key aspects of scope—topic selection and materiality matrixes—comparing approaches proposed by regulators and standard setters, as well as prominent ESG ratings and score providers.

Although we find significant differences in the nomenclature, granularity, and organization of ESG topics across standard setters and ESG score providers, there is ultimately considerable overlap in the topics that each considers. Perhaps surprisingly, we find little indication that the materiality approach (financial, double, or dynamic) that individual ESG models subscribe to meaningfully impacts topic selection either by standard setters or ESG score providers.

There appears to be strong consensus that, depending on the specific characteristics of a company, ESG ratings and scores should be based on assessments that only consider a subset of the most material ESG issues. Standard setters (aside from SASB), however, typically do not provide guidance on how to determine appropriate assessment criteria by proposing that companies themselves determine the most material ESG issues affecting them.

In practice, the lack of materiality guidance has led ESG ratings and score providers to develop their proprietary materiality matrixes, which present a primary source of scope divergence across ESG models. Detailed materiality matrixes or detailed methodologies describing their composition are typically not available in the public domain, making systematic comparisons difficult.

Our research suggests three useful avenues to reduce scope divergence across ESG models (and the associated aggregate confusion):

1. *Harmonization of ESG topic descriptions across reporting standards.* Although their structure and labeling may differ, ESG topic lists are relatively similar in their content across standard setters and ESG score providers. Harmonizing nomenclature for ESG topics across ESG reporting standards would significantly enhance comparability across models and provide greater transparency and relevance for users, particularly when contrasting between ESG providers. Note that this would not prescribe any specific materiality conceptions (score providers could simply disregard topics they deem immaterial) or impose a single way of measuring these topics.
2. *Greater transparency on materiality matrixes used by score providers.* Materiality matrixes are a critical piece of the puzzle in building ESG ratings and scores. They are typically predicated on combining data-driven analysis with

subject-matter expertise; however, it is generally unclear how each provider balances between these factors to arrive at their materiality map. Providing greater transparency on materiality matrixes and highlighting the evidence base upon which they were constructed is critical to reduce the black box character of many ESG ratings and scores.

3. *Greater standardization and granularity in company-disclosed data related to their activities.* ESG score providers rely heavily on corporate activity data, such as revenue segment reporting, to define materiality groups and link these to relevant ESG topics. These disclosures, however, are often inconsistent and lack granularity, requiring estimates or subject-matter expertise to fill the gaps. Greater standardization and granularity in revenue reporting could systematically improve the accuracy of materiality assessments and reduce scope divergence.

APPENDIX

EXHIBIT A1

How Standard Setters and Regulators View Materiality

SASB	"In identifying sustainability topics that are reasonably likely to have material impacts, the SASB applies the **definition of 'materiality' established under the US securities laws.** According to the US Supreme Court, information is material if there is "a substantial likelihood that the disclosure of the omitted fact would have been viewed by the reasonable investor as having significantly altered the 'total mix' of information made available."
GRI	"Material topics: topics that represent the organization's **most significant impacts on the economy, environment, and people,** including impacts on their human rights." "While most, if not all, of the impacts that have been identified through this process **will eventually become financially material**, sustainability reporting is also highly relevant in its own right as a public interest activity and is independent of the consideration of financial implications."
EFRAG	"The standard-setter should adopt conceptual guidelines establishing that **double materiality** […]." "**Double materiality has two dimensions, namely: impact materiality and financial materiality** […] Impact materiality and financial materiality assessments are inter-related and the interdependencies between these two dimensions shall be considered. In general, the starting point is the assessment of impacts. A sustainability impact may be financially material from inception or become financially material when it becomes investor relevant, including due to its present or likely effects on cash-flows, development, performance and position in the short-, medium- and long-term time horizons. Irrespective of their being financially material, impacts are captured by the impact materiality perspective."
TCFD	"How should material information be determined? Organizations should determine materiality for climate-related issues **consistent with how they determine the materiality of other information included in their annual financial filings.** The Task Force cautions organizations against prematurely concluding that climate-related risks and opportunities are not material based on perceptions of the longer-term nature of some climate-related risks. When providing disclosures outside mainstream financial filings, asset managers and asset owners should consider materiality in the context of their respective mandates and investment performance for clients and beneficiaries."
WEF	"Our perspective is that the recommended metrics reflect **not only financial impacts but 'pre-financial' information that may not be strictly material in the short term, but are material to society and planet and therefore may become material to financial performance over the medium or longer term.** Materiality is a dynamic concept, in which issues once considered relevant only to social value can rapidly become financially material. In this sense, sustainable value creation lies at the intersection of social and corporate value. The concept of dynamic materiality, as understood by the five leading voluntary framework- and standard-setters, is captured in …"
ISSB	"Sustainability-related financial information is material if omitting, misstating or obscuring that information could reasonably be expected to influence decisions that the primary users of general purpose financial reporting make on the basis of that reporting, which provides information about a specific reporting entity."

SOURCES: SASB (2017), WEF (2020b), GRI (2021), TCFD (2021b), EFRAG (2022a), ISSB (2022a).

EXHIBIT A2

How ESG Rating and Score Providers View Materiality

Bloomberg	"ES Scores can also be used to compare company sustainability performance within peer groups, as determined by the Bloomberg ESG Classification Scheme (BECS). BECS leverages BICS groups, in some instances combining groups to create custom peer groups based on similar exposures to **financially material** ESG risks and opportunities."
FTSE Russell	"The Exposure is measured primarily through (a) the ICB Subsectors where a company is active and (b) its presence in specific countries. The specific Subsectors and countries which are applicable varies by Theme. All the Theme Exposures are determined using a **rules based methodology** that is **derived from publicly available information and data sources**. For Exposure each company is categorised as High, Medium, Low or Not Applicable for each of the 14 Themes."
ISS ESG	"ISS ESG research applies a stakeholder, or **double materiality**, approach for a holistic and inclusive dataset on ESG performance." "When influence is understood in financial terms as the company's economic value creation for the benefit of investors, then the information reporting on this influence is known as financial materiality. When influence is understood in terms of the company's impact on society and the environment, then the information reporting on this influence is known as impact materiality [...] ISS has always focused its sustainability approach on this double materiality understanding."
MSCI	"Our ESG ratings are designed to look at the **financial significance** of ESG issues. Institutional investors such as pension funds, sovereign wealth funds, endowments and asset managers who have a fiduciary duty to consider significant investment risks commonly use ESG ratings to assess financial risks in the investment process."
Refinitiv	"Magnitude weights are **based on the level of disclosure** of each data point in a given industry group" or "the question of materiality, or in other words, the relative weight, is determined by the **relative median value** for a company in that industry group."
S&P Global	"We identify **financially material** factors as those that may have a present or future impact on a company's value drivers, earnings capacity, competitive positioning, or long-term value for its shareholders and if those factors have a significant impact on society or the environment. Material ESG issues are those that can affect the entity's business operations, cash flows, legal or regulatory liabilities, access to capital or reputation, as well as relationships with key stakeholders, the environment, or society more broadly—either directly or through its value chain (both upstream and downstream). We thus consider **double materiality** as an integral part of the analysis of corporate sustainability performance."
Sustainalytics	"A material ESG issue (MEI) is the core building block of the ESG Risk Rating. For Sustainalytics, an ESG issue is material if it is likely to have a **significant effect on the enterprise value** of a typical company within a subindustry, and if the presence or absence of an MEI in financial reporting is likely to influence the decisions made by a reasonable investor."

SOURCES: Bloomberg (n.d.), FTSE Russell (n.d.), MSCI (n.d.b), S&P (n.d.), Sustainalytics (2020), ISS (2022), Refinitiv (2022).

EXHIBIT A3

High-Level ESG Topic Definitions

	ESG Topic	Description
Environmental	Biodiversity	Relates to a company's management of the impact its operations might have on biodiversity and natural ecosystems
	Climate Physical Risk	Relates to a company's exposure to and management of physical risks stemming from climate change
	Climate Transition Risk	Relates to how a company manages its greenhouse gas emissions and the risks posed by the low-carbon transition
	Energy and Resource Use	Relates to a company's approach to the use of energy and raw materials
	Waste and Pollution	Relates to a company's approach to reducing waste and pollution in its production and operational processes
	Water	Relates to a company's approach to freshwater management and use, as well as freshwater scarcity risk

(continued)

EXHIBIT A3 *(continued)*

High-Level ESG Topic Definitions

	ESG Topic	Description
Social	Community Relations	Relates to how a company manages its relationship with and impacts on local communities close to its operations
	Diversity and Inclusion	Relates to how a company approaches diversity and inclusion issues; this can be within the workforce, board, or another part of the company
	Health and Safety	Relates to a company's effectiveness in terms of maintaining a healthy and safe workplace for its workers and other relevant stakeholders
	Human Rights	Relates to how a company manages and upholds the human rights of its employees and relevant stakeholders
	Labor Standards	Relates to a company's management of the rules and regulations governing working conditions for its employees—for example, working time, employment stability, workers' representation rights, minimum wages
	Product and Marketing	Relates to a company's capacity to produce quality goods and services and market them appropriately
Governance	Board and Management	Relates to how effectively the organization is directed and controlled
	Bribery and Corruption	Relates to how a company manages risks associated with malpractice or illegal activities related to its operations or workforce from bribery or corruption
	Data Security	Relates to how a company manages risks related to information security and customer privacy
	Risk Management	Relates to how a company approaches risk management, including the systems, controls, and frameworks it has in place to address broad ESG risks across the organization
	Shareholders	Relates to how a company manages risks associated with shareholders' rights and ensures the company is managed in line with their interests
	Tax Transparency	Relates to how a company manages its tax affairs
Other/Cross-Cutting	Supply Chain Related	Relates to a company's approach to managing ESG risks within its supply chain
	Economic and Other Impacts	Relates to the economic impact of a company's operations—for example, taxes paid, shareholder value created, approaches to innovation, and pensions supported

EXHIBIT A4

Categorizing ESG Issues within Regulatory and Reporting Standards

		Environmental						Social						Governance						Other	
Theme Title	Framework	Biodiversity	Climate Physical Risk	Climate Transition Risk	Energy and Resource Use	Waste and Pollution	Water	Community Relations	Diversity and Inclusion	Health and Safety	Human Rights	Labor Standards	Product and Marketing	Board and Management	Bribery and Corruption	Data Security	Shareholders	Risk Management	Tax Transparency	Supply Chain Related	Economic and Other Impacts
Biodiversity and Ecosystems	EFRAG	Y*																			
Biodiversity 2016	GRI	Y*																			
Nature Loss	WEF	Y*																			
Physical Impacts of Climate Change	SASB		Y*																		
Emissions 2016	GRI			Y*		Y															
GHG Emissions	SASB			Y*																	
Climate Change	WEF			Y*																	
Climate Change	EFRAG		Y	Y*																	
Climate-Related Disclosures	ISSB		Y	Y*																	

(continued)

EXHIBIT A4 *(continued)*

Categorizing ESG Issues within Regulatory and Reporting Standards

		Environmental						Social						Governance						Other	
Theme Title	Framework	Biodiversity	Climate Physical Risk	Climate Transition Risk	Energy and Resource Use	Waste and Pollution	Water	Community Relations	Diversity and Inclusion	Health and Safety	Human Rights	Labor Standards	Product and Marketing	Board and Management	Bribery and Corruption	Data Security	Shareholders	Risk Management	Tax Transparency	Supply Chain Related	Economic and Other Impacts
Resource Use and Circular Economy	EFRAG				Y*																
Energy 2016	GRI				Y*																
Materials 2016	GRI				Y*																
Energy Management	SASB				Y*																
Materials Sourcing and Efficiency	SASB				Y*															Y	
Resource Availability	WEF				Y*																
Pollution	EFRAG					Y*															
Waste 2020	GRI					Y*															
Effluents and Waste 2016	GRI					Y*															
Air Quality	SASB					Y*															
Ecological Impacts	SASB	Y				Y*															
Waste and Hazardous Materials Management	SASB					Y*															
Air Pollution	WEF					Y*															
Solid Waste	WEF					Y*															
Water Pollution	WEF					Y*															
Water and Marine Resources	EFRAG	Y			Y		Y*														
Water and Effluents 2018	GRI					Y	Y*														
Water and Wastewater Management	SASB					Y	Y*														
Fresh Water Availability	WEF						Y*														
Affected Communities	EFRAG							Y*			Y										
Local Communities 2016	GRI							Y*													
Market Presence 2016	GRI							Y*	Y			Y									
Community and Social Vitality	WEF							Y*											Y		Y
Rights of Indigenous Peoples 2016	GRI							Y*			Y										
Human Rights andCommunity Relations	SASB							Y*			Y										
Diversity and Equal Opportunity 2016	GRI								Y*			Y		Y							
Employee Engagement, Diversity, and Inclusion	SASB								Y*			Y									
Dignity and Equality	WEF								Y*		Y	Y									
Employee Health and Safety	SASB									Y*											
Occupational Health and Safety 2018	GRI									Y*											
Health and Wellbeing	WEF									Y*		Y									
Security Practices 2016	GRI										Y*										
Own Workforce	EFRAG								Y	Y	Y	Y*									
Child Labor 2016	GRI										Y	Y*									
Employment 2016	GRI								Y			Y*									
Forced or Compulsory Labor 2016	GRI										Y	Y*								Y	
Freedom of Association and Collective Bargaining 2016	GRI											Y*									
Labor/Management Relations 2016	GRI											Y*									

(continued)

EXHIBIT A4 *(continued)*

Categorizing ESG Issues within Regulatory and Reporting Standards

		Environmental						Social						Governance						Other	
Theme Title	**Framework**	Biodiversity	Climate Physical Risk	Climate Transition Risk	Energy and Resource Use	Waste and Pollution	Water	Community Relations	Diversity and Inclusion	Health and Safety	Human Rights	Labor Standards	Product and Marketing	Board and Management	Bribery and Corruption	Data Security	Shareholders	Risk Management	Tax Transparency	Supply Chain Related	Economic and Other Impacts
Nondiscrimination 2016	GRI								Y			Y*									
Training and Education 2016	GRI								Y			Y*									
Labor Practices	SASB											Y*									
Skills for the Future	WEF											Y*									
Consumers and End Users	EFRAG												Y*								
Customer Health and Safety 2016	GRI												Y*								
Marketing and Labeling 2016	GRI												Y*								
Access and Affordability	SASB												Y*								
Customer Welfare	SASB												Y*								
Product Quality and Safety	SASB												Y*								
Selling Practices and Product Labeling	SASB												Y*								
Governing Purpose	WEF													Y*							
Quality of Governing Body	WEF													Y*							
Business Conduct	EFRAG														Y*			Y			
Anticompetitive Behavior 2016	GRI														Y*			Y			
Anticorruption 2016	GRI														Y*						
Public Policy 2016	GRI														Y*						
Business Ethics	SASB														Y*			Y			
Competitive Behavior	SASB														Y*			Y			
Management of the Legal and Regulatory Environment	SASB														Y*						
Ethical Behavior	WEF														Y*			Y			
Customer Privacy 2016	GRI															Y*					
Customer Privacy	SASB															Y*					
Data Security	SASB															Y*					
Stakeholder Engagement	WEF							Y				Y					Y*				
Systemic Risk Management	SASB															Y		Y*			
Business Model Resilience	SASB			Y														Y*			
Critical Incident Risk Management	SASB									Y								Y*			
Risk and Opportunity Oversight	WEF		Y															Y*			
Tax 2019	GRI																		Y*		
Product Design and Lifecycle Management	SASB												Y							Y*	
Workers in the Value Chain	EFRAG										Y	Y								Y*	
Supplier Social Assessment 2016	GRI																			Y*	
Procurement Practices 2016	GRI																			Y*	
Supplier Environmental Assessment 2016	GRI																			Y*	
Supply Chain Management	SASB																			Y*	
Economic Performance 2016	GRI		Y	Y														Y			Y*
Indirect Economic Impacts 2016	GRI							Y													Y*

(continued)

EXHIBIT A4 *(continued)*

Categorizing ESG Issues within Regulatory and Reporting Standards

		Environmental						Social						Governance						Other	
Theme Title	Framework	Biodiversity	Climate Physical Risk	Climate Transition Risk	Energy and Resource Use	Waste and Pollution	Water	Community Relations	Diversity and Inclusion	Health and Safety	Human Rights	Labor Standards	Product and Marketing	Board and Management	Bribery and Corruption	Data Security	Shareholders	Risk Management	Tax Transparency	Supply Chain Related	Economic and Other Impacts
Employment and Wealth Generation	WEF											Y									Y*
Innovation in Better Products and Services	WEF																				Y*
General Disclosures	EFRAG	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		Y	
General Disclosures 2021	GRI							Y	Y		Y	Y		Y			Y	Y			
General Requirements	EFRAG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Material Topics 2021	GRI	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Foundation 2021	GRI	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
General Requirements for Disclosure of Sustainability-Related Financial Information	ISSB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NOTES: Themes are categorized by ESG topic pillar as per the topics in Exhibit A3. In some cases, the assigned pillar (environmental, social, governance, or other) in our study was different from the pillar assigned in the original framework (e.g., MSCI categorizes its *privacy and data security* theme under a social pillar, rather than governance as in this study). Categorization is by the primary topic (denoted by an asterisk in Exhibits A4 and A5) in the instance that a theme can be categorized under multiple ESG topics across more than one pillar (e.g., the SASB theme *materials sourcing and efficiency* covers primarily the *energy and resource use* theme in the "environmental" pillar but also the *supply chain related* theme in the "other" pillar). Three of the 38 GRI standards are sector specific and therefore are not included in this analysis. *Cells containing an asterisk (Y*) represent the primary topic categorization.

SOURCES: GRI (n.d.), SASB (n.d.), WEF (2020b), EFRAG (2022b), ISSB (2022a, 2022b).

EXHIBIT A5

Categorizing ESG Issues among ESG Rating and Score Providers

		Environmental						Social						Governance						Other	
Theme Title	Company	Biodiversity	Climate Physical Risk	Climate Transition Risk	Energy and Resource Use	Waste and Pollution	Water	Community Relations	Diversity and Inclusion	Health and Safety	Human Rights	Labor Standards	Product and Marketing	Board and Management	Bribery and Corruption	Data Security	Shareholders	Risk Management	Tax Transparency	Supply Chain Related	Economic and Other Impacts
Biodiversity and Land Use	MSCI	Y*																			
Land Use and Biodiversity	Sustainalytics	Y*																			
Biodiversity	S&P	Y*																			
Biodiversity	FTSE R	Y*																			
Sustainable Forestry Practices	S&P	Y*																			
Climate Change Vulnerability	MSCI		Y*	Y																	
Carbon Emissions	MSCI			Y*																	
Product Carbon Footprint	MSCI			Y*																	
Carbon—Own Operations	Sustainalytics			Y*																	

(continued)

EXHIBIT A5 *(continued)*

Categorizing ESG Issues among ESG Rating and Score Providers

		Environmental						Social						Governance						Other	
Theme Title	**Company**	**Biodiversity**	**Climate Physical Risk**	**Climate Transition Risk**	**Energy and Resource Use**	**Waste and Pollution**	**Water**	**Community Relations**	**Diversity and Inclusion**	**Health and Safety**	**Human Rights**	**Labor Standards**	**Product and Marketing**	**Board and Management**	**Bribery and Corruption**	**Data Security**	**Shareholders**	**Risk Management**	**Tax Transparency**	**Supply Chain Related**	**Economic and Other Impacts**
Carbon—Products and Services	Sustainalytics			Y*	Y																
Climate Strategy	S&P		Y	Y*																	
Climate Change	FTSE R			Y*	Y																
Emissions	Refinitiv			Y*		Y															
Asset Closure Management	S&P			Y*																	
Environmental Policy and Management Systems	S&P	Y		Y*	Y	Y	Y														
Raw Material Sourcing	MSCI				Y*																
Resource Use	Sustainalytics				Y*		Y														
Fuel Efficiency	S&P				Y*																
Operational Eco-efficiency	S&P			Y	Y*	Y	Y														
Packaging	S&P				Y*																
Resource Conservation and Resource Efficiency	S&P				Y*		Y														
Resource Use	Refinitiv				Y*		Y													Y	
Energy Mix	S&P			Y	Y*																
Fleet Management	S&P				Y*																
Electricity Generation	S&P				Y*																
Transmission and Distribution	S&P				Y*																
Mineral Waste Management	S&P				Y*																
Recycling Strategy	S&P				Y*																
Building Materials	S&P				Y*																
Renewable Energy	MSCI				Y*																
Green Building	MSCI			Y	Y*																
Toxic Emissions and Waste	MSCI					Y*															
Electronic Waste	MSCI					Y*															
Packaging Material and Waste	MSCI					Y*															
Emissions, Effluents, and Waste	Sustainalytics					Y*															
Coprocessing	S&P					Y*															
Pollution and Resources	FTSE R				Y	Y*															
Food Loss and Waste	S&P					Y*															
Water Stress	MSCI						Y*														
Water Operations	S&P						Y*														
Water-Related Risks	S&P						Y*														
Water Security	FTSE R						Y*														
Community Relations	MSCI							Y*													
Community Relations	Sustainalytics							Y*													
Social Impacts on Communities	S&P							Y*													
Stakeholder Engagement	S&P							Y*				Y					Y				
Corporate Citizenship and Philanthropy	S&P							Y*													

(continued)

EXHIBIT A5 *(continued)*

Categorizing ESG Issues among ESG Rating and Score Providers

		Environmental						Social						Governance						Other	
Theme Title	Company	Biodiversity	Climate Physical Risk	Climate Transition Risk	Energy and Resource Use	Waste and Pollution	Water	Community Relations	Diversity and Inclusion	Health and Safety	Human Rights	Labor Standards	Product and Marketing	Board and Management	Bribery and Corruption	Data Security	Shareholders	Risk Management	Tax Transparency	Supply Chain Related	Economic and Other Impacts
Health and Safety	MSCI									Y*											
Occupational Health and Safety	Sustainalytics									Y*											
Occupational Health and Safety	S&P									Y*											
Health and Safety	FTSE R									Y*											
Human Rights	Sustainalytics										Y*										
Human Rights	S&P										Y*										
Human Rights and Community	FTSE R							Y			Y*										
Human Rights	Refinitiv										Y*										
Labor Management	MSCI											Y*									
Human Capital Development	MSCI								Y			Y*									
Human Capital	Sustainalytics								Y			Y*									
Human Capital Development	S&P											Y*									
Labor Practice Indicators	S&P								Y			Y*									
Talent Attraction and Retention	S&P								Y			Y*									
Labor Standards	FTSE R								Y		Y	Y*									
Workforce	Refinitiv								Y	Y		Y*									
Social Reporting	S&P							Y		Y	Y	Y*	Y					Y			
Living Wage	S&P											Y*									
Chemical Safety	MSCI												Y*								
Brand Management	S&P												Y*					Y			
Product Safety and Quality	MSCI												Y*								
Environmental and Social Impact of Products and Services	Sustainalytics												Y*								
Access to Basic Services	Sustainalytics												Y*								
Product Governance	Sustainalytics												Y*								
Addressing Cost Burden	S&P												Y*								
Responsibility of Content	S&P												Y*								
Product Stewardship	S&P				Y								Y*								
Customer Relationship Management	S&P												Y*								
Customer Responsibility	FTSE R												Y*								
Product Responsibility	Refinitiv												Y*			Y					
Marketing Practices	S&P												Y*								
Product Quality and Recall Management	S&P												Y*								
Consumer Financial Protection	MSCI												Y*								
Access to Health Care	MSCI												Y*								Y
Passenger Safety	S&P												Y*								
Strategy to Improve Access to Drugs or Products	S&P												Y*								Y
Health and Nutrition	S&P												Y*								
Network Reliability	S&P												Y*					Y			

(continued)

EXHIBIT A5 *(continued)*

Categorizing ESG Issues among ESG Rating and Score Providers

		Environmental						Social						Governance						Other	
Theme Title	**Company**	**Biodiversity**	**Climate Physical Risk**	**Climate Transition Risk**	**Energy and Resource Use**	**Waste and Pollution**	**Water**	**Community Relations**	**Diversity and Inclusion**	**Health and Safety**	**Human Rights**	**Labor Standards**	**Product and Marketing**	**Board and Management**	**Bribery and Corruption**	**Data Security**	**Shareholders**	**Risk Management**	**Tax Transparency**	**Supply Chain Related**	**Economic and Other Impacts**
Sustainable Finance	S&P												Y*								Y
Sustainable Agricultural Practices	S&P	Y											Y*								
Strategy for Emerging Markets	S&P												Y*								
Corporate Governance	S&P								Y					Y*			Y				
Ownership	MSCI													Y*			Y				
Board	MSCI													Y*							
Corporate Governance	Sustainalytics								Y					Y*			Y				
Corporate Governance	FTSE R								Y					Y*			Y				
Management	Refinitiv								Y					Y*			Y				
Pay	MSCI													Y*							
Anticrime Policy and Measures	S&P														Y*						
Codes of Business Conduct	S&P														Y*			Y			
Compliance with Applicable Export Control Regimes	S&P														Y*			Y			
Community	Refinitiv							Y				Y			Y*						
Business Ethics	MSCI														Y*			Y			
Business Ethics	Sustainalytics														Y*			Y	Y		
Bribery and Corruption	Sustainalytics														Y*						
Anticorruption	FTSE R														Y*						
Policy Influence	S&P														Y*						
Information Security/Cybersecurity and System Availability	S&P															Y*					
Privacy and Data Security	MSCI															Y*					
Data Privacy and Security	Sustainalytics															Y*					
Privacy Protection	S&P															Y*					
Shareholders	Refinitiv																Y*				
Materiality	S&P																	Y*			
Accounting	MSCI													Y				Y*			
Environmental Reporting	S&P	Y	Y	Y	Y	Y	Y											Y*			
Risk Management	FTSE R																	Y*			
CSR Strategy	Refinitiv																	Y*			
Risk and Crisis Management	S&P																	Y*			
Financial Stability and Systemic Risk	S&P																	Y*			
Resilience	Sustainalytics																	Y*			
Tax Transparency	MSCI																		Y*		
Tax Transparency	FTSE R																		Y*		
Tax Strategy	S&P																		Y*		
Local Impact of Business Operations	S&P																			Y*	
Land Use and Biodiversity—Supply Chain	Sustainalytics	Y																		Y*	
Supply Chain Labor Standards	MSCI											Y								Y*	

(continued)

EXHIBIT A5 *(continued)*

Categorizing ESG Issues among ESG Rating and Score Providers

		Environmental						Social						Governance						Other	
Theme Title	Company	Biodiversity	Climate Physical Risk	Climate Transition Risk	Energy and Resource Use	Waste and Pollution	Water	Community Relations	Diversity and Inclusion	Health and Safety	Human Rights	Labor Standards	Product and Marketing	Board and Management	Bribery and Corruption	Data Security	Shareholders	Risk Management	Tax Transparency	Supply Chain Related	Economic and Other Impacts
Human Rights—Supply Chain	Sustainalytics										Y									Y*	
Resource Use—Supply Chain	Sustainalytics				Y		Y													Y*	
Supply Chain Management	S&P										Y									Y*	
Supply Chain: Environmental	FTSE R			Y	Y	Y	Y													Y*	
Supply Chain: Social	FTSE R								Y	Y	Y	Y								Y*	
Controversial Sourcing	MSCI										Y									Y*	
Innovation Management	S&P																				Y*
Market Opportunities	S&P																				Y*
Low-Carbon Strategy	S&P			Y																	Y*
Clean Tech	MSCI																				Y*
Innovation	Refinitiv																				Y*
Social Integration and Regeneration	S&P							Y													Y*
Financing Environmental Impact	MSCI	Y	Y	Y	Y	Y	Y														Y*
Responsible Investment	MSCI												Y								Y*
Access to Finance	MSCI												Y								Y*
Opportunities in Nutrition and Health	MSCI												Y								Y*
ESG Integration—Financials	Sustainalytics												Y								Y*
Financial Inclusion	S&P												Y								Y*
Health Outcome Contribution	S&P												Y								Y*
Genetically Modified Organisms	S&P																				Y*
Efficiency and Reliability	S&P																				Y*
Partnerships Toward Sustainable Healthcare	S&P																				Y*
Sustainable Construction	S&P																				Y*

NOTES: Themes are categorized by ESG topic pillar as per the topics in Exhibit A3. In some cases, the assigned pillar (environmental, social, governance, or other) in our study was different from the pillar assigned in the original framework (e.g., MSCI categorizes its *privacy and data security* theme under a social pillar, rather than governance as in this study). Categorization is by the primary topic (denoted by an asterisk in Exhibits A4 and A5) in the instance that a theme can be categorized under multiple ESG topics across more than one pillar (e.g., the SASB theme *materials sourcing and efficiency* covers primarily the *energy and resource use* theme in the "environmental" pillar but also the *supply chain related* theme in the "other" pillar). Topic lists were not publicly available at the time of research for Bloomberg and ISS and thus have been omitted. *Cells containing an asterisk (Y*) represent the primary topic categorization.

SOURCES: Sustainalytics (n.d.), FTSE Russell (2020), Refinitiv (2022), S&P (2022), MSCI (2023).

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