Review

Approaches on the Screening Methods for Materiality in Sustainability Reporting

Susie Ruqun Wu 1,*,†, Changliang Shao 2,† and Jiquan Chen 1,†

1 Center for Global Change and Earth Observations, Department of Geography, Environment and Spatial Sciences, Michigan State University, East Lansing, MI 48824, USA; jqchen@msu.edu
2 Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Beijing 100081, China; shaochangliang@caas.cn
* Correspondence: ruqunvi@hotmail.com; Tel.: +1-517-884-1884
† These authors contributed equally to this work.

Received: 26 July 2018; Accepted: 4 September 2018; Published: 10 September 2018

Abstract: Recent decades have seen a surge in corporate sustainability reports (SRs); their proliferation, however, does not ensure effective and consistent reporting on materiality. To improve the completeness, consistency and uniformity of SRs, this study aims at providing a review on the definition and identification of materiality and to propose screening methods for materiality assessments using publicly available resources. We found that most acknowledged standards and initiatives diverge in their definitions and approaches towards materiality. Four screening methods are proposed, including two that are directly usable: (1) Sustainability Accounting Standards Board Materiality Map™ and (2) Global Reporting Initiative (GRI) Sustainability Topics for Sectors; and two involving more desktop research: (3) GRI’s Sustainability Disclosure Database and (4) modeling from a life-cycle perspective. The second and third approaches are tested through a comparison study for the apparel and energy industries in selected regions using content analysis. The results indicate that the two approaches, with different levels of complexity, yield inconsistency in obtaining the most (i.e., the top three) material topics. The GRI’s Sustainability Disclosure Database is recommended for practitioners due to its balanced disclosure on management, economic, environmental and social sustainability themes.

Keywords: materiality; sustainability reporting; global Reporting Initiative; content analysis

1. Introduction

Materiality is a key term used within current corporate sustainability reports (SRs). It is expected that companies shall choose the most material issues for their sustainability challenges and act and disclose accordingly [1]. The concept of corporate sustainability has been continuously evolving and expanding, as has the confusion regarding how to interpret materiality [2]. Simply put, materiality is an element of utmost importance [3,4].

Large quantities of empirical literature have already addressed the amount and quality of information on material topics addressed within SRs. One cohort of studies revealed cross-sector differentiations in reporting [5,6]. Another cohort of studies focused on cross-region/country examinations on published SRs [7–9]. There are also studies on investigating how corporate governance [5,10,11] or company structure [12,13] influence an entity’s sustainability disclosure.

Regardless of the proliferation of SRs and relevant literature, incompleteness and inconsistency have been identified as major limitations in approaching materiality and SRs [1]. Many SRs have been criticized for lack of completeness, consistency and uniformity in covering relevant material aspects [2,14–16]. In today’s complicated world, diversified and sometimes contradicting aspects
of societal, environmental and economic issues proliferate and it is easy to get lost when selecting and prioritizing material topics for sustainability disclosure, implementation and monitoring [3]. Companies sometimes become too selective, screening out issues that they should be reporting [17].

Practically, substantial variations can be found in how companies define, identify and present materiality. It was found that while the world’s largest 250 companies were reporting “materiality” in their SRs back in 2013, only 59% explained the process used to identify “materiality” [18]. Four years later, it was found that companies still failed in reporting materiality effectively [19]. Discrepancies were found when looking at how large companies (e.g., BMW and Scheneider-Electric [20,21]) presented their materiality matrices compared to the method suggested by the Global Reporting Initiative (GRI), as the aforementioned companies use “importance/relevance to the organization” for the x-axis of their matrices as opposed to “impacts to the organization” as suggested by the GRI.

Facing the large variations and inconsistencies toward materiality, this review attempted to address the theoretical and practical needs of clarifying the definition of materiality and improving the completeness, consistency and uniformity in SRs by answering the following research questions:

1. What are the various approaches toward defining and understanding materiality from the perspectives of different stakeholders?
2. How can one avoid “re-inventing the wheel” and screen out the most important material topics using publicly available resources and by which screening methods?
3. Will different screening methods (with various degrees of complexity) yield relatively consistent results in screening material topics for selected industries?

By investigating these research questions, a theoretical contribution could be achieved by clarifying the definition of materiality and improving the completeness and uniformity in SRs. Empirical contribution is added to the ever-growing discussion on cross-sector and/or cross-country material topics. Practical contribution is realized by allowing sustainability reporters to apply screening methods to truncate unnecessary topics before conducting internal research to further fine-tune the materiality issues. This will enable companies to avoid tedious work during preliminary assessment by absorbing current industrial knowledge while at the same time ensuring the completeness and consistency of SRs.

2. Research Framework

The first research question is answered by reviewing the following sources: (1) the GRI, (2) the International Integrated Reporting Council (IIRC), (3) the Sustainability Accounting Standards Board (SASB) and (4) the Environmental, Social and Governance (ESG) disclosures introduced by the Sustainable Stock Exchanges (SSE). The first three serve as the most acknowledged standards but diverge in their approaches towards materiality decision-making [1]. The adoption of the fourth shows an emerging trend, for example, compulsory requirements by the Directive 2014/95/EU [22], or a compulsory or voluntary requirement by roughly 70 Stock Exchanges worldwide for their listed companies.

To answer the second research question, we search and propose screening methods to serve as the preliminary assessment for materiality analysis, utilizing external and publicly available resources. We first focus on targeting open-source data/databases, followed by paid databases that are widely adopted and acknowledged. This will inevitably lead to a large discrepancy in the degrees of complexity for the proposed methods, from directly accessible and useable resources, to complex modeling with existing databases and/or data analysis.

The third research question is answered by using published SRs and GRI-listed sustainability topics in a comparison study. Two selected screening methods with different levels of complexity are tested to observe their consistency in obtaining material topics for selected industries.
3. Research Findings

3.1. Research Question 1—Approaches toward Materiality

3.1.1. Materiality in GRI

Materiality is referred to by the GRI as a concept borrowed from financial reporting, reflecting the significant economic, environmental and social impacts of a company, or their influences on the assessments and decisions of stakeholders [23]. The GRI requires that a company reporting its material topics for a claim on the SR be in accordance with GRI standards. However, only general suggestions rather than specific guidelines or tools are provided by the GRI for assessing materiality. It is reasoned that, as an independent standard-setter, the GRI is not responsible for providing interpretations of content or for providing detailed advice on its implementation; it is up to the judgment of the reporting organization to interpret a concept set within the standard.

3.1.2. Materiality in IIRC

A more recent sustainability reporting framework is the Integrated Reporting Framework by the IIRC. It has six broad categories of capital: financial, manufactured, intellectual, human, social and relationship and natural capitals. The Integrated Reporting Framework states that a matter is material “if it could substantively affect the organization’s ability to create value in the short, medium or long term” [24].

The IIRC’s process of determining materiality is similar to that of the general processes offered by the GRI: (1) establishing the scope of the materiality determination process; (2) filtering, evaluating and prioritizing matters by their relevance and importance via both quantitative and qualitative assessments; and (3) setting the reporting boundary and finalizing disclosures.

3.1.3. Materiality in SASB

The SASB covers sustainability topics under five categories: Environment, Social Capital, Human Capital, Business Model and Innovation and Leadership and Governance. The SASB defines that “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” [25].

The approach that the SASB takes in determining materiality is informed by the provisions of the United States federal securities laws, as well as various regulations of the Securities and Exchange Commission (SEC) [26]. The SASB specifically differentiates its definition on materiality from both the GRI and IIRC [25].

3.1.4. Materiality in ESG Reporting of SSE

Other than the above voluntary international initiatives, the SSE initiative has been promoting corporate ESG disclosure from publically listed companies worldwide. A total of 68 SSE Partner Exchanges have already participated in the initiative [27].

Unlike other standard-setting organizations, the SSE does not provide guidelines on SR, and/or define materiality; instead, it has generated a model guidance for all stock exchanges when developing guidance for their issuers. As of 28 May 2018, a total of 38 stock exchanges have published detailed guidances for their listed companies to follow while reporting ESG [28].

Among those offering ESG guidelines, the definition on materiality varies substantially among individual stock exchanges. Some explicitly define and propose detailed processes, tools and templates for assessing ESG factors for their listed companies (e.g., Singapore Stock Exchange [29]). Other stock exchanges (e.g., Australian Securities Exchange [30]) require materiality assessments to follow GRI
or SASB approaches. There are also a few stock exchanges that do not specifically define materiality, such as the Shenzhen Stock Exchange [31].

3.1.5. Different Perspectives toward Materiality

The major difference in approaching materiality for the first three standard-setting guidelines is the distinct categories of stakeholders and their perspectives (Table A1). The SASB identifies topics that are reasonably likely to contain materials from the perspective of investors, whereas the GRI covers all stakeholders [25]. For ESG reporting, the approach toward materiality also varies among individual stock exchanges. For example, the London Stock Exchange Group specifically focuses on the investors’ materiality. Similar patterns were common in the financial industry. Masud et al. (2018) studied green regulations within the Bangladesh bank sector and found a narrower scope in both the stakeholder engagement and disclosed topics than the GRI [32].

Another independent research group studied the alignment and differentiation in definitions of materiality between company and investors. It analyzed two approaches to define material topics by investigating three industry sectors: Mining, Metals and Electric Utilities [33]. The first approach is to investigate the GRI reports from companies in the three sectors to observe what companies consider to be material. The second approach is to survey investors to understand what they consider to be sustainability topics of financial materials. The results showed that the degrees of alignment varied across different sectors. The least alignment was reported for the Electric Utilities sector as investors considered Customers and Innovation most important; companies, on the other hand, found Occupational Health and Safety and Communities most important [33].

3.2. Research Question 2—Screening Methods for Preliminary Assessment of Materiality

3.2.1. Approach 1: Directly Accessible—SASB Materiality Map™

The Materiality Map™ is an online interactive tool that is developed, updated and aligned with the sustainability issues of the SASB. The map provides a preliminary assessment to “identify likely material sustainability issues on an industry-by-industry basis” and is used to identify and compare disclosure topics across different industries and sectors [34].

Two measurements, the Heat Map (HM) score and the Industry Working Group (IWG) score, are used as the “Evidence of Materiality” to identify whether an issue/topic is material to an industry. The HM score is objective and based on the frequency of keywords in documents (i.e., SEC filings, shareholder resolutions, legal news, key newswires and Corporate Social Responsibility (CSR) reports) that are available on the Bloomberg terminal for an industry’s publicly listed companies. Whereas the IWG score is subjective and is the percentage of IWG participants who agreed that the issue is to be material. Overall, environmental issues are a dominant theme in the Transportation sector, while social and human capital are prominent in the Services sector.

3.2.2. Approach 2: Directly Accessible—GRI Sustainability Topics for Sectors

During 2012–2013, the GRI started a project to identify the sustainability topics that different stakeholders consider material for a total of 52 business sectors [35]. A final 1612 topics were proposed for 52 business sectors, with specific “Proposed Topics” identified for each business sector. A total of 616 reference documents are directly accessible from the GRI website [36].

Depending on the nature of different business sectors, the number of identified topics varied largely. Overall, 33 out of the 52 (i.e., 63%) business sectors had over 20 Proposed Topics identified. The Oil and Gas sector obtained the maximum number of 96 Proposed Topics. On the other hand, ten out of the 52 sectors had less than 10 Proposed Topics.
3.2.3. Approach 3: Desktop Research—GRI Sustainability Disclosure Database

The GRI’s Sustainability Disclosure Database (hereafter GRI Database) is a free-to-use public database containing a total of 47,479 SRs (of which 29,806 are GRI Reports) for 12,289 organizations as of 1 May 2018 \[37\]. The database can be used with different hierarchies of complexity to serve as a screening method for the preliminary assessment, depending on the specific purpose of a user. For example, one can simply find one or several targeting competitors with similar scales within the same market to observe what they are reporting on material topics; one can also find one or more leading market player(s) for benchmarking purposes.

A method that can be used to scrutinize published SRs is content analysis. In brief, content analysis is used for making “replicable and valid inferences from texts (or other meaningful matters) to the contexts of their use” \[38,39\]. Specifically, content analysis has been widely used to analyze patterns in CSR reporting, serving a general review and/or model development purpose \[2,22,40\], or targeting specific industries \[38,41\].

3.2.4. Approach 4: Desktop Research—Modeling from a Life Cycle Perspective

From the full life-cycle/supply-chain perspective, the Social Life Cycle Assessment (SLCA) has been suggested to be used to identify “material” (GRI) and “relevant” (ISO 26000) labor, human rights and social hot spots \[42\]. The rationality behind identifying materiality from the life-cycle perspective is through decoding the GRI guidelines, which require companies to understand their supply chain risks holistically. The GRI standards have multiple topics that specifically require disclosure on environmental and social impacts from the supply chain.

Practically, screening SLCA and Environmental LCA (ELCA) have been applied in several case studies to assess and pinpoint the social and environmental material aspects within the agri-food sector \[10\]. The major tool used is the Social Hotspots Database, which was developed based on several guidelines and standards, including for example the GRI G3 Guidelines and the Global Social Compliance Program reference tools \[43\].

3.2.5. (Dis)advantages of the Proposed Screening Methods

A major advantage of the first two directly accessible methods (approaches 1 & 2) is the simplicity for usage, apart from the fact that they are developed and maintained by accredited institutions for data credibility. Their simplicity and convenience are largely due to the extensive background research already done by their developers (Table A2). For the same reason, one of their limitations is that the output is fixed to a certain extent (e.g., the users cannot filter information based on their own preferences). For example, for GRI Sustainability Topics for Sectors, 112 organizations with business natures have over 50% as global business, while the rest are mainly from Europe, North America and Oceania. Only one company is from Africa and two are from Asia \[44\] (p. 13). Thus, it might not be representative for a company based in Asia to screen its material topics using this method.

In contrast, the third method presented—using the GRI Sustainability Disclosure Database to filter topics—can address spatial context, as one can specify a region/country for any registered GRI reports from the GRI database. The data analysis method proposed—content analysis—is scientifically robust and can yield industrially insightful messages. Nevertheless, to the knowledge of the authors, no major software packages is available for conducting content analysis in languages other than English. This limitation, along with the extra information processing required (either with the content analysis proposed here or other data analysis methods), may hinder the practicality of using the GRI Database as a preliminary assessment method.

The advantage of conducting SLCA and/or ELCA screening is to add an extra layer of robustness and objectivity into the materiality assessment. PRE \[45\] suggested integrating the science-based LCA—following objective results where the product/organization has a significant impact—with the subjective perception of what is important as channeled from stakeholders. Nevertheless, extra costs
will be incurred as commercial databases and/or software are needed for the analysis. The application of life-cycle based tools for the preliminary assessment of materiality fits well for those reporting entities who follow GRI guidelines, while it may not be worth the effort if one is following other protocols with a focus on specific stakeholders (e.g., investors).

3.3. Research Question 3—Comparing the Selected Screening Methods

3.3.1. Case Selection, Data Collection and Analysis Method

Case Selection

Two out of the four proposed screening methods, approaches 2 and 3, are tested and compared for their consistency in obtaining preliminary material topics. They are both GRI-derived. Approach 2 (hereafter “GRI Topics”) is directly accessible and simple, while Approach 3 (hereafter “GRI Database”) involves more extensive information processing and data analysis. Approach 1 is not selected due to its over-simplification of screening material topics. For example, under the “apparel, accessories and footwear” industry, only three topics are screened, whereas the GRI Topics identifies a total of 59 Topics. Approach 4 is also not exercised, as we are only interested in utilizing freely-available resources at this stage.

The following industries and regions have been selected for comparison:

1. The apparel industry in Hong Kong and Italy is selected to observe the discrepancy between concerned topics by companies and GRI Topics (which should be focused on theoretically).
2. The energy industry is selected with a broader geographical scope (i.e., entire Asia) to observe the consistency obtained from the GRI Topics and the concerned topics reported by the industry in Asia.

The apparel and energy industries have been selected because they are directly related to basic human needs. They supply fundamental public resources and are important to inform various stakeholders about the reporting status for their sustainability [46]. At the spatial scale, Hong Kong is selected as a focus region due to its economic prosperity and expansion of ESG reporting in recent years (as compulsorily required by the Hong Kong Stock Exchange (HKEx)). Italy is added for the apparel industry due to its legendary iconic status and prominence in this industry. The Asian energy market is selected due to the fact that many oil-producing companies are located within the region, yet a limited number of studies on their business sustainability exist compared to its European and/or North American counterparts.

Data Collection

The GRI-Reports-List-Database (available for free download) [47]) serves as the starting point for the GRI Database. The industry and selected regions/countries will be screened out from the list. The industries screened out are: textiles and apparel and energy. The corresponding companies and their SRs will then be downloaded from the GRI Database [37].

For the GRI Database, only SRs (downloaded as PDF files) meeting the following criteria are used: (1) in character format so that information can be extracted by the computer; (2) in English; and (3) 2016 or later SRs, regardless of their type (e.g., whether it is a GRI report, GRI citing, non-GRI SR, integrated report, or ESG reports).

For GRI Topics, business sectors #19 and #47 of [44] are selected for the selected industries correspondingly, with slightly different naming. Sector #19 is textiles, apparel, footwear and luxury goods, with a total of 59 Topics; Sector #47 is electric utilities and independent power producers and energy traders (including fossil, alternative and nuclear energy), with a total of 71 Topics [44].
Analysis Method

The content analysis is used to extract the most frequently occurring words within SRs from the GRI Database and those from GRI Topics to imply frequently disclosed sustainability topics. This is the same method (i.e., word counts) used in various literatures on sustainability disclosure [2,5,38,40,41,48].

To extract sustainability topic words, we base our method on current mainstream literature and list a total of 15 content themes, that is, theme\(_{(i)}\), \(i = 1–15\) (Table 1), falling under five major sustainability business categories (i.e., Management, Economic, Environment, Social and Operational).

To compare the two approaches and see if they yield consistent results in obtaining material topics, the absolute word counts extracted from each approach are then converted to a proportional indicator. This is to compare the various degrees of attention paid to each theme by the two approaches, while disregarding other non-relevant information.

A two-sample proportional test is then applied to each of the 15 themes (theme\(_{(i)}, i = 1–15\) ) to statistically test if the two approaches result in the same material topics (theme\(_{(i)}, i = 1–15\) ) for each studied industry. The test is to verify whether each theme\(_{(i)}\) receives a relatively same amount of disclosure, by using the proportional word counts, that is, the word counts for theme\(_{(i)}\) divided by the total word counts of all themes. This hypothesis is expressed as:

\[
H_0: P_{1,\text{theme}(i, i = 1-15)} = P_{2,\text{theme}(i, i = 1-15)} \quad \text{H}_1: P_{1,\text{theme}(i, i = 1-15)} \neq P_{2,\text{theme}(i, i = 1-15)}
\]

where:

\(P_{1,\text{theme}(i, i = 1-15)}\): proportion of theme \(i\) for GRI Database, which is the word counts for theme \(i\) divided by the total word counts of all themes;

\(P_{2,\text{theme}(i, i = 1-15)}\): proportion of theme \(i\) for GRI Topics, which is the word counts for theme \(i\) divided by the total word counts of all themes.

Table 1. The sustainability business categories, their corresponding sustainability themes and the keywords selection for the content analysis.

<table>
<thead>
<tr>
<th>Sustainable Business Category</th>
<th>Content Theme</th>
<th>Keywords Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>Management</td>
<td>Management, governance</td>
</tr>
<tr>
<td>Economic</td>
<td>Financial performance</td>
<td>Cash, fiscal, economic, financial</td>
</tr>
<tr>
<td>Environment</td>
<td>Emissions &amp; GHG</td>
<td>Emission, greenhouse gas (GHG), carbon</td>
</tr>
<tr>
<td>Energy</td>
<td>Energy</td>
<td>Energy, energy(in)efficiency, energy-saving, energy-use</td>
</tr>
<tr>
<td>Water</td>
<td>Freshwater, water,</td>
<td>freshwater, water, groundwater, base saving, watershed</td>
</tr>
<tr>
<td>Waste &amp; wastewater</td>
<td>Waste</td>
<td>Waste, wastewater, disposal, landfill, recycle</td>
</tr>
<tr>
<td>Resources &amp; materials</td>
<td>Material, resource</td>
<td>material, package</td>
</tr>
<tr>
<td>Chemicals &amp; heavy metals</td>
<td>Chemical</td>
<td>chemical, metal, pesticide, chromium, cobalt, copper,</td>
</tr>
<tr>
<td></td>
<td>lead</td>
<td>lead, mercury, nickel, zinc</td>
</tr>
<tr>
<td>Social</td>
<td>Employment &amp; labor</td>
<td>Employ, labor</td>
</tr>
<tr>
<td>Health &amp; safety</td>
<td>Health</td>
<td>health, safety, injury</td>
</tr>
<tr>
<td>Training</td>
<td>Train</td>
<td>train, educate</td>
</tr>
<tr>
<td>Community</td>
<td>Community, volunteer</td>
<td>community, volunteer, donate</td>
</tr>
<tr>
<td>Operational</td>
<td>Supply chain</td>
<td>Supplier, sourcing</td>
</tr>
<tr>
<td>Quality control</td>
<td>Quality</td>
<td>quality, complaint</td>
</tr>
<tr>
<td>Regulation &amp; compliance</td>
<td>Compliance</td>
<td>compliance, regulate, specification, standard, law</td>
</tr>
</tbody>
</table>

3.3.2. Comparison of GRI Database versus GRI Topics—Apparel Industry

Three companies from Hong Kong and three companies from Italy were used for analysis through the screening criteria for SRs. The six SRs are combined to observe the material topics
that the industry chose to disclose, which is compared with what GRI Topics suggests the industry shall disclose (Figure 1a).

- SRs from GRI Database indicate that the dominant material topics the industry chooses to disclose include: employment & labor, management and quality control; whereas GRI Topics considers chemicals & heavy metals, supply chain and resources & materials as the most material (Table 2). None of the most material topics align and all differ statistically.
- The two-sample proportional test shows that, statistically at a $p$-value of 0.1, nine out of 15 themes require similar amounts of sustainability disclosure by both GRI Database and GRI Topics, mostly on environmental topics (Table 2).
- Both approaches agree on the amounts of information disclosure on the topic relating to management. Economic information has only been disclosed by the industry and not included in GRI Topics.
- GRI Topics requires more disclosure on all environmental themes than that disclosed by the industry, except for emissions & GHG. Specifically, GRI Topics requires the highest degree of disclosure on chemicals & heavy metals (20% of total sustainability disclosure), whereas it receives the lowest amount of attention in companies’ SRs from GRI Database.
- Compared to environmental themes, reversed patterns are observed for social themes, as the industry discloses more information on all four social themes, with only health & safety results in similar proportion although statistically insignificant.
- Compared to management, economic, environmental and social themes, which show a clear pattern, the operational theme shows a more diverse result; industry tends to pay more attention to product quality whereas GRI Topics focuses more on the supply chain issues.

3.3.3. Comparison of GRI Database versus GRI Topics—Energy Industry

A total of 24 energy companies in various countries in Asia were used for analysis through the screening criteria for PDF reports. The following numbers of companies for each country/region are identified: 3 in the United Arab Emirates, 1 in Bahrain, 2 in Hong Kong, 4 in India, 3 in Japan, 1 in South Korea, 1 in Qatar, 3 in Thailand, 3 in Turkey, 1 in Taiwan and 2 in Vietnam. Combining all 24 companies together, their most focused-on topic is compared with the GRI Topics that are disclosed by the industry (Figure 1b).

- SRs from GRI Database indicate that the dominant material topics the industry chooses to disclose include: management, employment & labor and regulation & compliance; whereas GRI Topics considers management, energy and water the most material (Table 2). While management topic aligns, the remaining two topics differ statistically.
- The two-sample proportional test shows that, statistically at a $p$-value of 0.1, 10 out of 15 themes require similar amounts of sustainability disclosure by both GRI Database and GRI Topics, including four environmental and five social themes other than management (Table 2).
- Similar findings on the disclosure on management and economic information can be found for the apparel industry.
- GRI Topics requires more disclosure on all environmental themes than those disclosed by the industry, with energy and water related topics showing statistical significance.
- Similar to the apparel industry, a reversed pattern for social themes is obtained compared to environmental aspects, as the industry discloses more information on all social themes than GRI Topics. However, only employment & labor topic shows statistical significance.
- For operational themes, GRI Topics, like the apparel industry, also focuses more on supply chain issues, whereas the other two topics do not show significant differences.
Figure 1. Bar plot of relative disclosures for the two approaches (Global reporting initiative (GRI) Database vs. GRI Topics) on various sustainability themes for apparel (a) and energy (b) industry. Data labels show the weights of each theme, summing up to 100% vertically for each approach. The vertical red line indicates an even disclosure on a theme by the two approaches.
Table 2. The amount of disclosure put on each sustainability theme by GRI Database and GRI Topics for apparel and energy industries.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Industry</th>
<th>Absolute Word Counts</th>
<th>Proportional Word Counts</th>
<th>p-Value (Two Sample Proportional Test)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>GRI Database</td>
<td>GRI Topics</td>
<td>GRI Database</td>
</tr>
<tr>
<td>Management</td>
<td>Apparel</td>
<td>533</td>
<td>7</td>
<td>12% (#2, A)</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>5163</td>
<td>12</td>
<td>13% (#1, E)</td>
</tr>
<tr>
<td>Financial performance</td>
<td>Apparel</td>
<td>237</td>
<td>0</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>3419</td>
<td>1</td>
<td>8%</td>
</tr>
<tr>
<td>Emissions &amp; GHG</td>
<td>Apparel</td>
<td>250</td>
<td>4</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>2370</td>
<td>9</td>
<td>6%</td>
</tr>
<tr>
<td>Energy</td>
<td>Apparel</td>
<td>142</td>
<td>4</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>3391</td>
<td>21</td>
<td>8%</td>
</tr>
<tr>
<td>Financial performance</td>
<td>Apparel</td>
<td>126</td>
<td>5</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>1660</td>
<td>12</td>
<td>4%</td>
</tr>
<tr>
<td>Waste &amp; wastewater</td>
<td>Apparel</td>
<td>257</td>
<td>5</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>1746</td>
<td>5</td>
<td>4%</td>
</tr>
<tr>
<td>Resources &amp; materials</td>
<td>Apparel</td>
<td>404</td>
<td>9</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>2269</td>
<td>6</td>
<td>6%</td>
</tr>
<tr>
<td>Chemicals % heavy metals</td>
<td>Apparel</td>
<td>54</td>
<td>16</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>612</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Employment &amp; labor</td>
<td>Apparel</td>
<td>585</td>
<td>4</td>
<td>13% (#1, A)</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>4743</td>
<td>1</td>
<td>12% (#2, E)</td>
</tr>
<tr>
<td>Health &amp; safety</td>
<td>Apparel</td>
<td>372</td>
<td>4</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>3590</td>
<td>9</td>
<td>9%</td>
</tr>
<tr>
<td>Training</td>
<td>Apparel</td>
<td>208</td>
<td>0</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>2079</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>Community</td>
<td>Apparel</td>
<td>193</td>
<td>0</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>2049</td>
<td>3</td>
<td>5%</td>
</tr>
<tr>
<td>Supply chain</td>
<td>Apparel</td>
<td>383</td>
<td>12</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>1679</td>
<td>9</td>
<td>4%</td>
</tr>
<tr>
<td>Quality control</td>
<td>Apparel</td>
<td>413</td>
<td>2</td>
<td>9% (#3, A)</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>2611</td>
<td>6</td>
<td>6%</td>
</tr>
<tr>
<td>Regulation &amp; compliance</td>
<td>Apparel</td>
<td>325</td>
<td>7</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
<td>3665</td>
<td>6</td>
<td>9% (#3, E)</td>
</tr>
</tbody>
</table>

Note: proportional word counts are rounded. Numbers in bold show the top-three material topics identified for each industry. “A” indicates apparel and “E” indicates energy industry. * and ** is statistical significance at p-value of 0.1 and 0.05, respectively.

3.3.4. Implications

Using the apparel and energy industries in selected regions, the two screening methods tested do not yield high consistencies in identifying most material topics. Management, regardless of industry and/or screening methods, is a key topic addressed. While management is not a measurable indicator/topic within SRs, it certainly serves as an overarching expression, as sustainability is a management process within the corporate setting.

The economic pillar of sustainability is revealed as a key topic disclosed by industry SRs. However, it is not listed as material by GRI Topics. A possible explanation could be that the development of most sustainability initiatives tends to focus on environmental and social aspects, as a counterbalance to the traditional focus on financial performance. Nevertheless, the most updated 2016 GRI Standards lists a more balanced disclosure as six sub-standards are devoted to economic disclosure, while environmental aspects receive eight sub-standards. Key focus is still put on social aspects, with a total of 19 sub-standards. This focus on social aspects in GRI Standards may also serve as a sound explanation for why companies disclose more social-related information.

Supply chain is a common material topic identified by GRI Topics for both industries, yet under-reported by the industry. As explained under screening approach 4—the life cycle approach,
GRI pays specific attention to environmental and social impacts from the whole supply chain. The real-world application, however, may still lack implementation. A similar pattern is identified when comparing the two approaches on environmental topics. It is possible that companies remain ill-prepared to record and report environmental topics as compared to social ones.

While large quantities of empirical literature have addressed how various SRs address material topics [5,6,8,9,32], this study does not aim to provide another detailed review of cross-country or cross-sector examinations of SRs. Instead, the results and analysis from our comparison study can yield several practical and managerial implications.

Practically, it has been suggested that the GRI Database approach serves as a preferred option for screening out the materiality issues during preliminary assessment. The results obtained are not only based on up-to-date industrial knowledge but also achieved a more balanced and consistent disclosure with the GRI standards on four sustainability themes: management, economic, environmental and social. GRI Topics, on the other hand, aligns better with the whole supply chain principle adopted by GRI Standards. It also places more emphasis on environmental disclosure than both companies’ SRs and GRI Standards themselves.

The theoretical emphasis placed on environmental issues by GRI Topics is not groundless and can be studied to a certain extent by managerial teams for decision-making. GRI Topics are identified through a robust process by reviewing hundreds of reference documents, including various government and NGO publications, industry standards and guidelines [36]. Companies can use it to re-think whether and how managerial focus shifts toward environmental and operational topics whenever necessary.

The results obtained from comparing the two approaches might not be conclusive to generalize to other industries and/or regions, as only two industries within certain countries are studied. Another problem encountered when benchmarking different screening methods are the inconsistencies in defining and categorizing industry sectors. While some overlaps of naming conventions are apparent, many others are different among the methods. Overall, the SASB Materiality Map™ covers 10 major sectors with over 70 sub-sectors/industries. GRI Topics covers a total of 52 Business Activity Groups. The GRI Database groups all SRs into 38 industry sectors and the LCA modeling approach does not pre-define a sector.

Method-wise, the content analysis performed in this study can only extract one word each time and can pick up and configure some key terms consisting of short names such as GHG but cannot recognize more complicated key phrases such as life cycle assessment. Content analysis itself can be manipulated at different degrees of detail and complexity. For example, Beck et al. [49] developed a very sophisticated Consolidated Narrative Interrogation algorithm to span multiple degrees of information diversity, information content and volume within environmental reports. While it is justifiable that our simple word counts-based analysis be used for comparison purposes, some key pieces of information, such as those not based on simple word counts, could be left unnoticed or omitted. More detailed algorithms for content analysis/data mining are needed if a more detailed analysis is to be performed or conclusive results to be reached.

4. Conclusions

In this study, we first review the definition of and approaches toward materiality from several international initiatives. We then propose screening methods with the aim of providing a preliminary assessment of materiality, two of which—the GRI Database and GRI Topics—are compared with selected industries and regions. We demonstrate a relatively low consistency in obtaining most material topics from the two approaches. Companies may use the GRI Database for screening out non-material issues during the preliminary assessment, as it is based on up-to-date industrial knowledge and achieve a balanced disclosure on various sustainability themes.

Author Contributions: Conceptualization, S.R.W., C.S. and J.C.; Writing—Original Draft Preparation, S.R.W. and C.S.; Writing—Review & Editing, J.C.; Supervision, J.C.; Funding Acquisition, C.S.
Funding: This research was funded by the National Natural Science Foundation of China (41771205), the “Dynamics of Coupled Natural and Human Systems (CNH)” Program of the NSF (#1313761) and the Fundamental Research Funds for Central Non-profit Scientific Institution (No. 851-3).

Acknowledgments: The authors thank Xinchao Liu for his editing of the references and Connor Crank for her professional language editing.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Sustainability reporting guidelines, their focuses, disclosure requirements and approaches toward materiality.

<table>
<thead>
<tr>
<th>Sustainability Reporting Initiatives</th>
<th>Targeting Audience and Managerial Focus</th>
<th>Disclosure Requirement</th>
<th>Definition and Approach toward Materiality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Reporting Initiatives (GRI)</td>
<td>Various audience; external feedback from stakeholders needs [1]</td>
<td>Voluntary</td>
<td>Approached from perspective of all stakeholders</td>
</tr>
<tr>
<td>Sustainable Stock Exchanges Initiatives (SASB)</td>
<td>Mainly targeting regulators; focus on internal management [1]</td>
<td>Voluntary</td>
<td>Approached from perspective of investors</td>
</tr>
<tr>
<td>International Integrated Reporting Council (IIRC)</td>
<td>Mainly targeting investors, focus on internal management [1]</td>
<td>Voluntary</td>
<td>Approached from perspective of investors</td>
</tr>
<tr>
<td>Sustainable Stock Exchanges Initiative (SSE)</td>
<td>Various audience and focus depending on individual reporting guidelines of individual stock exchange</td>
<td>Depending on individual stock exchange</td>
<td>Various approaches by each stock exchange. Mostly with investors, asset owners, shareholders mostly included</td>
</tr>
</tbody>
</table>
Table A2. Screening methods using publicly available external resources for preliminary assessment of materiality.

<table>
<thead>
<tr>
<th>Approach</th>
<th>Method</th>
<th>Platform</th>
<th>Sectors Covered</th>
<th>Topics Covered</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Licensing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directly accessible</td>
<td>SASB Materiality Map™</td>
<td>Online interactive tool</td>
<td>10 sectors with over 70 sub-sectors</td>
<td>Covering SASB topics</td>
<td>Easy to use, quick to perform analysis and free; Solid and robust identification process of material topics, involving both objective Heat Map score and subjective Industry Working Group score.</td>
<td>Fixed output; Screened material topics only for SASB topics thus over-simplification if following other reporting guidelines.</td>
<td>Free to use, a licensing agreement with SASB needed</td>
</tr>
<tr>
<td></td>
<td>GRI Sustainability Topics for Sectors</td>
<td>PDF tables</td>
<td>52 business sectors</td>
<td>1612 Proposed Topics</td>
<td>Easy to use, quick to perform analysis and free; Transparent identification process of material topics and clearly stated in the report based on 616 references.</td>
<td>Not representative for certain industries within a specific geographical context.</td>
<td>N/A</td>
</tr>
<tr>
<td>With desktop research</td>
<td>GRI Sustainability Disclosure Database</td>
<td>Online database</td>
<td>38 business sectors</td>
<td>Not applicable (N/A)</td>
<td>Constantly evolving/adding new reports; Tailored to including targeting companies within a specific region, during a certain period.</td>
<td>Not directly usable; Further information processing/data analysis needed (e.g., content analysis).</td>
<td>Free to download reports listed on the database</td>
</tr>
<tr>
<td></td>
<td>SLCA and ELCA screening</td>
<td>Database and/or modeling software</td>
<td>N/A</td>
<td>N/A</td>
<td>Constantly evolving and adding new dataset; Science-based method with an extra layer of robustness and objectivity added; Fitting for those reporting entities following GRI guidelines with a broader stakeholder definition, including supply chain partners.</td>
<td>Time-consuming; Further expertise knowledge on ELCA/SLCA need; Extra cost involved.</td>
<td>Extra licensing and cost involved</td>
</tr>
</tbody>
</table>
References

1. Ortar, L. From flexibility to specificity: Practical lessons from comparing materiality in sustainability reports of the world’s largest financial institutions. *Int. J. Corp. Strategy Soc. Responsib.* 2016, 1, 44–64. [CrossRef]


48. Masud, M.A.; Mi Bae, S.; Kim, J.D. Analysis of environmental accounting and reporting practices of listed banking companies in Bangladesh. Sustainability 2017, 10, 1717. [CrossRef]