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Corporate Reporting on Solutions to Wicked Problems:

Sustainable Land Management in the Mining Sector

ABSTRACT

Land degradation is a wicked problem for social-ecological systems, addressed through international policy by the United Nations Convention to Combat Desertification (UNCCD). The UNCCD is striving towards land degradation neutrality – maintenance or improvement of the condition of the land – whereby degradation is prevented and reversed through sustainable land management (SLM) and restoration. Land degradation neutrality, and therefore SLM, is relevant to all land-based sectors. This paper focuses on the mining sector. It explores how mining companies and mining sector stakeholders conceptualize SLM; identifies the drivers of their engagement in SLM; examines how mining companies operationalize existing guidelines to report on SLM; and evaluates the implications of the ways in which companies report on SLM in terms of the UNCCD's efforts in moving towards land degradation neutrality. Our methodological approach includes semi-structured interviews with key mining and SLM stakeholders and content analysis of company sustainability reports. Findings identify a range of interpretations of SLM and suggest that companies are engaging in SLM largely due to the need to reduce their costs and risks. We find a variety of good and poor reporting practices. Differences in both SLM discourses and the quality of reporting have important implications in terms of stakeholders' abilities to understand and evaluate corporate SLM performance, their engagement in the implementation of the UNCCD, and ultimately, the progress made towards land degradation neutrality. Our findings suggest that the currently dominant format of corporate sustainability reporting does not lend itself easily to context-specific, wicked problems such as SLM. Furthermore, there is a need for improved communication, data sharing and knowledge management between mining and other SLM stakeholders; a need to seek further synergistic opportunities for reporting; and that the context of reporting needs to be more clearly presented if reports are to be more useful and meaningful in outlining SLM.

Keywords: sustainable land management; land degradation neutrality; mining; sustainability reporting; wicked problems

1. INTRODUCTION

Land degradation is a 'wicked' problem for integrated social-ecological systems. Wicked problems are highly challenging to address, largely due to incomplete, contradictory and dynamic requirements that make them both complex and multi-factored (Bruggemann et al. 2012); they also suffer a lack of clarity in terms of a route towards an optimal solution (Moeliono et al. 2014). Such 'wickedness' is inherent to land degradation due to the interactions between ecological, social, political, cultural and economic drivers of the problem, which operate over varying temporal and spatial scales (Reynolds et al. 2007); the multiple actors and stakeholders affected by and implicated in land degradation and its impacts (Schwilch et al. 2009); and the variety of research disciplines

involved in the definition and identification of land degradation and the development and implementation of sustainable land management (SLM) solutions (Reed et al. 2011).

Policies play a key role in attempts to address wicked problems. The key international policy framework for addressing land degradation is the United Nations Convention to Combat Desertification (UNCCD), which entered into force in 1996 (Stringer 2008). The UNCCD recognizes the importance of involving stakeholders including local communities, Non-Governmental Organizations (NGOs), civil society organizations, scientists and the private sector in efforts to move towards land degradation neutrality (Stringer et al. 2009). To date, the majority of analyses of progress in UNCCD implementation have focused on the agricultural sector. This has been justified in terms of pressing global challenges such as food, energy and water security and the cross-cutting role of land degradation therein (Thomas et al. 2012). However, mining is the fifth largest industry in the world and has largely been overlooked in terms of its potential to reorient land quality towards a more sustainable trajectory. The dominance of multi-national corporations (MNCs) in the mining sector means that this group is a key stakeholder in the maintenance of land quality into the future, especially as land is affected by mining throughout exploration, construction, operation, closure and post-closure stages of a mine's lifecycle (ICMM 2011).

The extraction aspects of mining cause the largest environmental and social impacts. In general, major environmental issues relating to the mining sector include the depletion of (mineral, land and other) resources; biodiversity loss; the need for land rehabilitation; product toxicity; water use, effluents and leachate management; emissions to air, liquid effluents and solid waste; energy use and contributions to global warming; and nuisance (Azapagic 2004; Miranda et al. 2012). Due to the presence of linkages and feedbacks, each of these environmental impacts can negatively affect the social (human) aspects of the system (Folke et al. 2002), highlighting the wicked character of the land degradation challenge.

While the UNCCD is striving towards land degradation neutrality, mining companies have been growing in their environmental consciousness, driven by national legislation and company commitments to Corporate Social Responsibility (CSR). In this context, corporate sustainability reporting is emerging as a mainstream practice, particularly among large MNCs (Kolk 2010; KPMG 2011). In essence, corporate sustainability reports should enable a company's stakeholders to benchmark and compare sustainability performance whilst allowing the company to demonstrate how it is meeting the sustainability challenges it faces (GRI 2011). At the same time, it is recognized that using more sustainable company practices can offer a competitive advantage in the corporate world, while for mineral-rich developing countries in particular, companies are the economic stakeholders that possess and can utilize the capacity, technologies and other resources to ensure more sustainable extraction activities. Many regulatory bodies and international organizations are involved in developing guidelines designed to enable companies to report. Some of the most commonly used voluntary guidelines are those provided by the Global Reporting Initiative (GRI).

The GRI reporting guidelines encompass a range of aspects that are relevant to SLM. As such, companies are expected to report on their SLM-related performance as part of their general sustainability disclosures. However, given the complex, context-specific and inter-related nature of land degradation, reporting on SLM is not trivial. For example, it is very difficult to quantify

sustainability impacts and disaggregate them to the level of the individual actor (Gray and Milne 2002; Gray 2010) or in this case, mine, particularly when large MNCs operate in a range of different contexts. The context-specific nature of SLM also raises questions regarding the ability of stakeholders to compare and benchmark corporate performance on the basis of the information that is reported.

The research literature on corporate reporting on wicked problems like land degradation and steps taken towards SLM can be described as nascent, concentrating largely on reporting in relation to biodiversity in just a few academic articles (Jones and Solomon 2013; Boiral 2014). The mining sector has been neglected within efforts to move towards SLM and land degradation neutrality, leaving an important knowledge gap regarding how mining companies and stakeholders understand SLM, how they adopt SLM and how they communicate their SLM practices. This paper addresses this gap by answering the following questions:

1) How do mining companies and mining sector stakeholders conceptualize SLM?
2) What motivates mining companies to engage in SLM?
3) How do mining companies operationalize existing reporting guidelines to report on SLM?

Our findings are discussed in terms of their implications for progressing towards a land degradation neutral world.

2. THEORETICAL BACKGROUND

2.1. Sustainable Land Management in the Mining Sector

SLM as a response to land degradation is defined in different ways by different groups. According to the UNCCD (UNCCD 2011, p. 4), SLM constitutes "land-use practices that ensure the land, water, and vegetation adequately support land-based production systems for both current and future generations" (UNCCD 2011, p. 6) and aims "to enhance the economic and social well-being of affected communities, sustain ecosystem services and strengthen adaptive capacity to manage climate change" (UNCCD 2011, p. 4). Other definitions such as that of TerrAfrica (FAO 2008) highlight the need for a "combination of technologies, policies and activities" (p. 21) to achieve an appropriate land management system which aims to "maintain or enhance production, reduce the level of production risk, protect the potential of natural resources and prevent soil and water degradation" (p. 21). These definitions build upon that in UNCED (1992), which considers SLM as "the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions".

We merge these definitions, such that SLM is defined as "the use of land resources (including soils, water and biodiversity) for the production of goods and services to meet changing human needs. SLM can be achieved through the use of both tools and actions. Overall, SLM should ensure the social acceptability, economic viability and long-term productive potential of land resources and their environmental functions." Our definition captures a time dimension in addition to the Triple-

Bottom-Line. It also distinguishes between tools and actions. (Tools provide an enabling environment and the laws, institutions, structures and processes to facilitate actions; actions are the enactment of SLM practices).

While NGOs, international organisations and civil society groups have devised development projects that address SLM in the mining sector, academic research that examines SLM and mining in the comprehensive sense of SLM is sorely lacking. The academic literature instead yields numerous papers on mining's environmental impacts (Azapagic 2004; Miranda et al. 2012); its social impacts (Hamann 2003); and the economic, social and environmental effects of mine closures (Veiga et al. 2001; Laurence 2006). While these literatures touch upon various aspects of SLM, they fail to link it to the UNCCD's SLM discourse and do not holistically address SLM in the mining sector.

2.2. Corporate Reporting on Solutions to Wicked Problems

Whilst corporate reporting on social and environmental performance can be traced back to so-called social accounts in the 1970s (Gray et al. 1995), its widespread application is more recent. Only in the 1990s and early 2000s did a significant number of companies started to produce stand-alone environmental or sustainability reports. Today, reporting has become mainstream practice, in particular among large listed companies: in 2011, 95% of Fortune Global 250 companies disclosed their social and environmental performance in a stand-alone or integrated report (KPMG 2011).

The GRI has emerged as the key normative body in the field of sustainability reporting (Etzion and Ferraro 2010; Levy et al. 2010), with several thousand companies using the GRI guidelines to shape their sustainability reports. Moreover, reporting according to the GRI guidelines is widely considered to enhance the credibility of a sustainability report (KPMG 2011). The GRI guidelines stipulate generic principles for the process of publishing a sustainability report, and standard disclosures specifying the content of these reports. The latter form the base content, specifying a set of performance indicators companies are expected to report on, covering different sustainability-related dimensions. The GRI (2010) also has a sector-specific protocol for metals and mining companies, prescribing additional indicators on which companies from this sector are expected to report.

Both corporate sustainability reports and the GRI guidelines have attracted considerable criticism (Gray and Milne 2002; Moneva et al. 2006). Not least due to the voluntary character of sustainability reporting, companies have been found to 'cherry pick' information (Gray 2006) and use non-financial disclosures as a legitimacy management tool rather than an accountability mechanism (Patten 1991; Gray et al. 1997). Given the significant environmental and socioeconomic impacts of the mining sector, it is unsurprising that many mining companies have become leaders in sustainability reporting (Böhling and Murguia 2014). At the same time, the sector has long been at the heart of these criticisms (Deegan et al. 2002; Fonseca et al. 2012). The potential mismatch between impression management and actual sustainability performance can be expected to be particularly pronounced in the context of wicked problems given their complexity and dynamic nature.

Previous studies have focused on corporate accounting and reporting on biodiversity, and found that the state of reporting is still embryonic (Jones and Solomon 2013). Low levels of awareness across the sector as well as issues of attributing wider societal impacts to individual companies make it difficult to arrive at consensus about what companies should report on, ultimately resulting in very

limited disclosures on biodiversity (Rimmel and Jonäll 2013; van Liempd and Busch 2013). Nevertheless – and despite criticisms directed at shortcomings of the GRI itself (Dumay et al. 2010; Barkemeyer et al. 2015) –widespread corporate sustainability reporting is still very recent, and the initiative clearly has helped to popularize and standardize these disclosures. Furthermore, there is a clear lack of studies that examine specific indicators and provide recommendations on how to improve corporate sustainability reporting practices (Fonseca et al. 2012).

3. METHODS & DATA

We employed a mixed methods approach, combining semi-structured interviews with corporate practitioners and mining sector stakeholders and a content analysis of mining company sustainability reports. Interviews explored how different stakeholders conceptualize SLM and what motivates their engagement in SLM (research questions 1 and 2). Content analysis of corporate sustainability reports shed light on strengths and limitations as well as good and poor practices in the current state of SLM disclosure in the mining sector (research question 3). Our analysis focused on companies operating in Peruvian and Zambian contexts, given the importance of the mining sector in these countries (Reichl et al. 2013).

3.1. Interviews with Corporate Practitioners and Mining Sector Stakeholders

Twelve semi-structured interviews were conducted with mining company representatives (n=5) and mining sector stakeholders. The latter included government officials (n=2), NGO representatives (n=3) and academics (n=2). Interviews captured a variety of views on both SLM and the SLM performance of companies operating in Peru and Zambia. Appendix 1 provides an overview of the sample employed for this stage of the analysis. Interviews were conducted by phone or Skype during July-August 2014 and lasted 50-90 minutes. Interviews aimed to get a deeper understanding of how respondents conceptualize SLM, identify motivations for engaging in SLM and ascertain the main challenges and current good practices. A loose interview structure was employed, mainly using open ended questions to allow deeper exploration of issues and to allow respondents' own experiences to emerge freely (Appleton 1995; Ingram 2008). All interviews were digitally recorded and transcribed. Transcriptions were organized using thematic analysis (Huberman and Miles 1994; Strauss and Corbin 1994). Following the protocol established by Huberman and Miles (1994) and Harris (2007), coding of transcripts was structured as a reiterative process involving open, axial, and selective coding. Open coding identified emergent topics and organized them into common themes; axial and selective coding identified and verified relationships between categories.

3.2. Analysis of Corporate Sustainability Reports

Content analysis of corporate sustainability reports was carried out during June-August 2014 to explore how mining companies report on their SLM performance. To identify a sample covering all relevant mining companies operating in Peru and/or Zambia, secondary literature, as well as corporate financial and sustainability reports of large mining companies were screened, using the Forbes Global 2000 list of companies and the Corporate Register database respectively, as sampling frames. Appendix 2 summarizes the companies in the sample. The period 2006-2013 was covered as the GRI G3 reporting framework came into force in 2006. At the time of analysis, no sustainability

reports for the year 2014 had been published. Content analysis encompassed two stages. First, the content of sustainability reports was screened using the GRI content index. For each of the 86 reports, the content was transcribed into an SPSS database for subsequent analysis. Each indicator the company claimed to have fully or partially addressed in the report was assigned the value 1; all indicators not addressed were marked as 0. In this initial step, the generic set of 79 core and additional GRI G3 indicators as well as those prescribed in the GRI Metals & Mining supplement were considered.

Second, an in-depth content analysis of sustainability reports was conducted to explore how, as well as the extent to which, companies report on SLM-specific aspects of their performance. Of key importance in this context was the extent to which the information provided enabled the reader of a sustainability report to understand and evaluate the SLM performance of the company. At this stage, we focused on a subset of 26 GRI indicators that – on the basis of an initial screening of corporate sustainability reports and the GRI reporting guidelines – could be expected to contain SLM-relevant information, as per our definition of SLM. Appendix 3 presents the indicators considered for this stage of the analysis and the SLM-dimension(s) each indicator refers to. Additionally, keyword searches were performed on each sustainability report to capture SLM-relevant information that was reported outside of these 26 indicators. This procedure identified specific tools such as biodiversity action plans, environmental management systems or environmental impact assessments that were referred to in other parts of the reports.

Whilst there is an extensive literature on indicator development and quality (Riley 2001; Spangenberg et al. 2002), for the purposes of this analysis we focused on the GRI's own perspective on the basic purposes of a GRI sustainability report. According to the GRI (2011, p. 3), readers of a sustainability report should be able to benchmark and assess sustainability performance with respect to relevant laws and guidelines; and compare performance between companies and over time. In addition, companies should demonstrate how they respond to expectations about sustainable development. It should be noted that the indicators prescribed by the GRI are not necessarily defined as performance indicators in a narrow sense, but typically specify wider performance dimensions which in turn can be operationalized in different ways by the reporting companies. As such, an exploratory approach was deemed more appropriate than a more rigid classification and evaluation of indicators to explore relevant report content. Again, a thematic analysis technique was applied (Huberman and Miles 1994; Strauss and Corbin 1994). As a starting point, we focused on the type of information that was provided (qualitative versus quantitative), transparency about underlying indicator definitions, and the geographic scope of the information being reported. However, the coding remained open to additional themes that emerged from the analysis.

4. RESULTS

4.1. Conceptualizing Sustainable Land Management and its Drivers

During semi-structured interviews, respondents were asked to describe or define SLM in their own words and to refine and provide feedback on our definition. Many views and SLM definitions were provided, often reflecting the respondents' own backgrounds and areas of interest. For example,

Corp2 and Corp4 view SLM through the lens of community engagement, whereas Corp 3 has a background in farming, so emphasised land based production systems. Respondents across each stakeholder category highlighted the cross-cutting, interconnected and multi-faceted nature of SLM, noting links between environmental and social-economic aspects of both the land degradation challenge and the SLM solution (e.g. Corp1, Gov2, NGO3). Some respondents were unwilling or unable to describe or define SLM. Corp1 stated *"I don't know if this is necessarily the term that companies use to think about the issue"* while Corp 2 considered that mining companies would instead use terms with a stronger focus on particular mining issues, such as 'mine closure' or 'community engagement'. This suggests that the mining sector tends to break down SLM into its various constituent parts. Corp2 noted that deforestation is a barrier to SLM and also highlighted the importance of a long-term vision and the legacy that today's actions can leave for future generations, showing important acknowledgement of the temporal dimension of SLM. Overall, the presence of parallel discourses facing different SLM issue areas and the range of different aspects of SLM that respondents mentioned, mirror the fragmented nature of the academic literature on the topic.

Respondents generally agreed with our SLM definition, with corporate practitioners offering the strongest agreement. Interviewees considered the broad nature of the definition to be both a strength and limitation. The strength is that it is comprehensive and includes all aspects that stakeholders would expect to be mentioned. This was highlighted particularly by practitioners and other stakeholders directly engaged with tasks that they identified as being SLM. Some interviewees nevertheless stressed that legislation regarding land occupation, such as illegal mining or farming, are a challenge for mining companies, and that these need to be more explicitly addressed by SLM. They also discussed problems arising from issues including overgrazing, which indirectly relate to mining. The limitation of the inclusive nature of SLM is that it makes it very challenging to operationalize a definition with so many different components and that it overlaps, sometimes substantially, with other discourses and definitions. Terms that interviewees suggested SLM overlaps with include ecosystem services, climate-compatible development and sustainable development. As such, there is confusion about the boundaries of each concept, as well as the geographical boundaries within which different groups are responsible and/or for SLM activities.

Corporate sustainability reporting emerged from the interview analysis as the primary way of communicating SLM-related actions taken by companies. However, stakeholders identified several drivers of company engagement in SLM. These include the need to comply with local regulations and national legislation (especially pertaining to water, mining and the environment); the need to honour commitments made to communities during the early stages of the mining operations and/or in gaining approval for the mine, thus helping companies to maintain their social licences to operate; keeping up with growing trends in corporate sustainability in competitor companies and international best practices – this was mentioned with particular reference to joint projects with regional agencies that touch upon aspects of SLM; pressure from investors and financing agencies; and to reduce overall risk and sustain the business. As one interviewee explained, SLM is important to: "*avoid the risk of damage to our water supply, our public credibility and our stakeholders, delays, blockages, interventions, inspections fines…all of this is done with the objective to manage risk and maintain quality of production*" (Corp5). Another noted that SLM reduces the risk of conflict but also reduces costs: "*You'll save the costs because you don't have to maintain such a big pool of lawyers or you don't have to waste resources in paying leaders or whatever"* (Gov2). Drivers therefore link

largely to legislative, economic and social factors, with the business case in support of SLM being a central concern.

When discussing drivers of SLM, several interviewees also alluded to some of the barriers to companies pursuing SLM. They pointed to a lack of government capacity and support; a lack of synergy and integration between different policies and regulations across sectors leading to a poor enabling environment for SLM; a lack of incentives such as certification, accolades or tax breaks for good SLM practices; disproportionate focus on infrastructure development at the expense of capacity building for SLM; and a lack of enforcement of laws and regulations. Indeed, some even went as far as to suggest that the influence of some mining companies can sometimes mean that they are able to sit outside the national legislation, particularly in countries where corruption and bribery are rife. These findings suggest the need for national government action if SLM is to be more of a central feature of mining companies' activities and their reporting.

4.2. Content Analysis of Corporate Sustainability Reports

Most mining companies in our sample published non-financial disclosures between 2008 and 2013, with 19/30 companies issuing stand-alone sustainability reports, 18 of which produced at least one report that followed the GRI reporting guidelines (see Appendix 2). Sustainability reporting is clearly a widespread practice among large developed and emerging economy mining MNCs, but less so among their smaller domestic peers. Furthermore, 16 out of these 18 reports produced in compliance with GRI guidelines achieved the highest GRI 'application level' of A^+ in their most recent sustainability report, indicating a high level of compliance with GRI guidelines as well as external assurance of the information provided.

Analysis of GRI indicators also shows that reporting has become increasingly comprehensive (Figure 1). In 2013, most reporting companies addressed all GRI 'core' indicators as well as each of the indicators defined in the mining and metals supplement. In contrast, only 59% of the additional indicators were addressed in the year 2013. In earlier years, companies still seemed to build up their reporting regimes. From 2008 onwards, coverage levels appear to plateau. In this context, it is interesting to note that coverage of additional indicators decreases between 2011 and 2013.

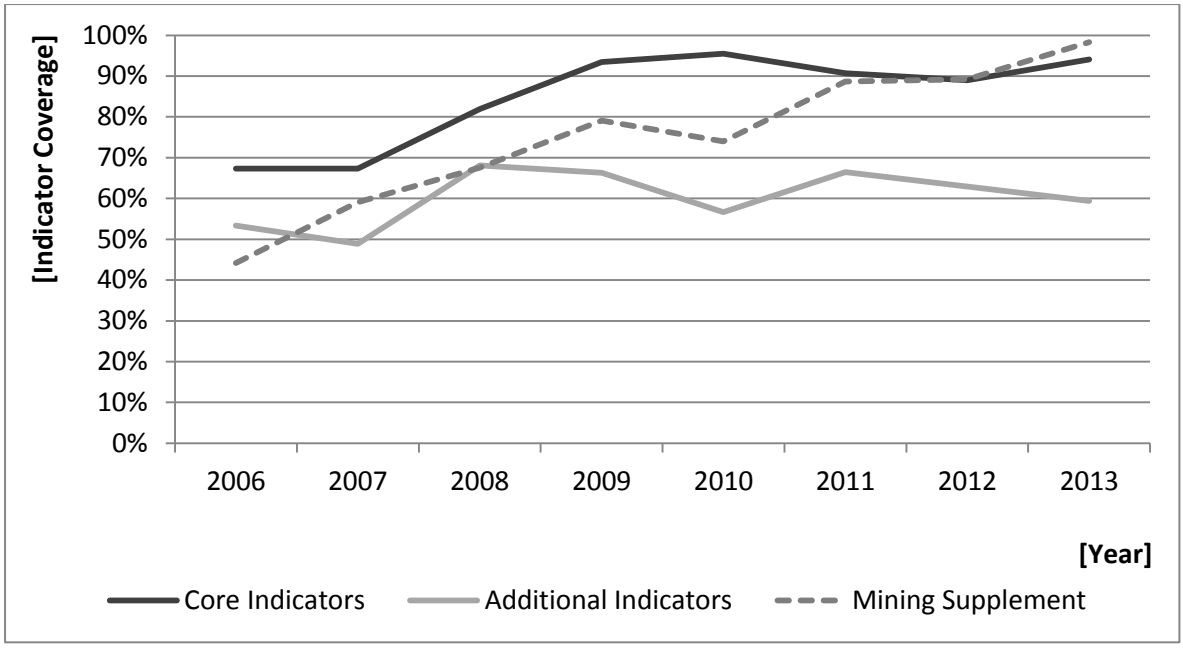

Figure 1: Coverage of GRI indicators over time (18 selected mining MNCs, 2006-2013)

Coverage levels per company for the years 2008-2013 largely replicate trends in overall GRI coverage. (See Appendix 4 for average coverage in relation to the set of 26 SLM-related GRI indicators). However, exceptions from these overall trends can be identified. For example, the Eurasian Natural Resources Corporation provides little information in its sustainability reports; as a general rule, Rio Tinto only reports on each of the core indicators as well as the mining and metals supplement; while at the other end of the spectrum, Adaro manages to address every single SLM-relevant indicator in the two sustainability reports that have been produced within the period under review (see Appendix 4). Average coverage levels of core indicators range between 85% (PR9) and 100% (EN8); Mining & Metals supplement indicators are equally well covered with levels between 80% (MM08) and 87% (MM01). Only in the case of additional indicators, coverage drops to levels of around 50% (EN15, EN25, EN39). Interestingly, a key omission overall is that of soil: no company is reporting on soil as a specific component of land, whereas they do report on water and biodiversity. To a certain extent, this can be linked back to the structure and content of the GRI reporting guidelines. The GRI Mining & Metals Supplement views soil production as part of biodiversity (GRI 2011, p. 31), but does not specify specific performance indicators dedicated to soil.

Overall, reporting has become markedly more comprehensive and standardized towards the later years under analysis. This provides evidence for increasing upward harmonization of reporting (Fortanier et al. 2011) and reflects the dominant position of the GRI guidelines in shaping corporate sustainability report content (Barkemeyer et al. 2015). From the perspective of SLM, mining companies are reporting on a wide range of aspects that are relevant for SLM performance. However, the second stage of the content analysis of corporate sustainability reports uncovered a number of significant shortcomings regarding the extent to which this information actually enables readers of these reports to understand and evaluate the issues at stake. Table 1 summarizes the analysis of report content in relation to the 26 GRI indicators identified as containing SLM-related information. A number of recurring limitations emerged that prevent stakeholders from using this information to compare and benchmark SLM performance.

Table 1: Content analysis of SLM-related GRI indicators

Indicator	Title	Category	Quantitative/ qualitative	SLM-specific or wider area	Geographical scope of information	Comments
EC01	Direct economic value generated and distributed	Economic	Qualitative & Quantitative	Wider area	Mainly global, some country-level information	Some companies disclose country-level tax payments; vast majority of data linked to global operations
EN08	Total water withdrawal by source	Water	Quantitative	SLM-specific	Global	Different underlying calculation methods - that are typically not disclosed, e.g. cooling water; no country-level information
EN09	Water sources significantly affected by withdrawal of water	Water	Qualitative	SLM-specific	Global, regional, national, local	Typically not reported or in the form of a very general narrative
EN10	Percentage and total volume of water recycled and reused	Water	Quantitative	SLM-specific	Global	Underlying definition of recycling; question of cooling water; contextual factors such as water scarcity; data exclusively linked to global operations
EN11	Areas of high biodiversity value outside protected areas	Biodiversity	Qualitative & Quantitative	SLM-specific	Mainly global, some country- and local-level information	Data provided but very difficult (if not impossible) to interpret without context - even for changes over time within the same company
EN12	Impacts on biodiversity	Biodiversity	Qualitative	SLM-specific	Global, regional, national, local	Typically not addressed or in the form of a more general narrative
EN13	Habitats protected or restored	Biodiversity	Qualitative & Quantitative	SLM-specific	Global, local	Typically not reported, global data or case studies
EN14	Strategies, current actions, and future plans for managing impacts on biodiversity	Biodiversity	Qualitative	SLM-specific	Global, local	Narrative - more tangible aspects e.g. BAP or other tools, guidelines, initiatives
EN15	IUCN Red List species	Biodiversity	Qualitative & Quantitative	SLM-specific	Global	Typically not reported; those companies that do usually provide one general list of species - notable exception e.g. Vale, but ordered by ecosystem types (i.e. not possible to make link to specific countries/operations)
EN21	Total water discharge by quality and destination	Water	Quantitative	SLM-specific	Global	Underlying definition often unclear; global-level data
EN22	Total weight of waste by type and disposal method	Waste	Qualitative & Quantitative	Wider area	Global	Typically global-level data - notable exception Barrick; underlying definitions typically unclear
EN23	Total number and volume of significant spills.	Waste	Qualitative & Quantitative	SLM-specific	Global	Typically aggregate number provided; very few cases in which it is possible to get basic understanding of the nature and impact of these incidents

EN25	Water bodies and related habitats significantly affected	Biodiversity / Water	Qualitative	SLM-specific	Global	Typically not reported or very general statements
EN28	Non-compliance with environmental laws and regulations	Economic	Qualitative & Quantitative	Wider area	Global	Typically global figure - in some cases more detailed description of contexts and fines
EN30	Total environmental protection expenditures and investments	Economic	Quantitative	Wider area	Global	Underlying calculation method typically unclear - difficult to compare any two companies
MM01	Land disturbed or rehabilitated	Soil/ Social	Quantitative	SLM-specific	Global	Underlying methodology unclear; different presentation methods, comparisons difficult – definition of 'disturbed' or 'rehabilitated' unclear
MM02	Biodiversity management plans	Biodiversity	Qualitative & Quantitative	SLM-specific	Global	Very general statements dominating; some companies stating percentage of operations covered by biodiversity management plans
MM03	Overburden, rock, tailings, and sludges and their associated risks	Soil/ Water/ Waste	Qualitative & Quantitative	SLM-specific	Global	Data provided; different underlying definitions of waste fractions; at times drastic restatements
MM06	Disputes relating to land use, customary rights of local communities and Indigenous Peoples.	Social	Qualitative & Quantitative	SLM-specific	Global, (local)	Data typically provided but few companies provide contextual information
MM07	Grievance mechanisms used to resolve disputes relating to land use and local communities	Social	Qualitative & Quantitative	SLM-specific	Global, local	Very little information provided - to the extent that it is difficult to identify general patterns in terms of content
MM08	Artisanal and small-scale mining (ASM)	Social	Qualitative	SLM-specific	Local	Predominantly qualitative information – brief narrative
MM09	Resettlements	Social	Qualitative & Quantitative	SLM-specific	Global, national and local	Number of households, in several cases combined with short description of contexts in which resettlement took place
MM10	Closure plans	Social	Qualitative & Quantitative	SLM-specific	Global	Environmental aspects typically stated to be covered; however, generally little reference to social and economic dimension
PR09	Non-compliance with laws and regulations concerning the provision and use of products and services	Economic	Qualitative & Quantitative	Wider area	Global, local	"None to report" as most frequent response
SO01	Local community engagement, impact assessments, and development programs	Social	Qualitative	Wider area	Global, local	Narrative - more tangible aspects e.g. tools, guidelines, initiatives
SO09	Operations with significant potential or actual negative impacts on local communities	Social	Qualitative	SLM-specific	Global, local	Coverage <10%; if reported, then in the form of a narrative

Type of information provided. In-depth analysis of report content showed that a relatively large number of indicators are typically addressed in a quantitative manner. Whilst narratives can clearly help the reader to get a deeper understanding of corporate performance – for example on the basis of case studies that illustrate and contextualize corporate activities - it would typically need to be supported by quantitative information that helps stakeholders to benchmark and compare performance. Indicators that are generally addressed in the form of a very general narrative include EN09 (water sources affected by withdrawal of water), EN12 (impacts on biodiversity) and MM08 (artisanal and small-scale mining).

Limited provision of SLM-related information. Given the ongoing (and currently only partial) emergence of SLM as a policy discourse in the mining sector, it is unsurprising that SLM does not emerge as a significant theme in the disclosures. Only one company in the sample explicitly refers to SLM practices in their sustainability reports (Xstrata, 2006, 2007). The information as part of SLM-relevant indicators generally appears fragmented and relatively limited. Several GRI indicators– based on the indicator definitions provided in the GRI guidelines – refer to a wider range of issues but would be expected to also report on SLM performance-related aspects. For example, indicators EC01 (direct economic value generated and distributed) or EN28 and PR09 (monetary value of significant fines for non-compliance with environmental and product/service-related regulations, respectively) could be expected to contain SLM-related information. However, very high levels of aggregation typically prevent the reader from making the link to any specific environmental or social performance-related aspects.

Geographical scope of information. Similar problems exist regarding the spatial dimension of SLM-related performance. Again, companies typically report highly aggregated information that does not allow the reader to understand and assess performance. For example, indicator EN13 (habitats protected or restored) is typically reported on a global level with no or little reference to the local or national contexts in which the companies operate. Likewise, indicator EN23 (number and volume of significant spills) commonly refers to the overall number of spills: so, quantitative information is provided but does not allow the reader to make the link to a specific operational context. Most companies provide a list of IUCN Red List species as part of indicator EN15, but often without reference to the specific contexts in which these species have been recorded. Across the sample of sustainability reports, information on the Peruvian and Zambian contexts the companies operate in is typically limited to generic descriptions of country-level operations.

Lack of transparency and comparability. Another recurring theme is that underlying indicator definitions used for quantitative information remain unclear. Without detailed information on how recycled water or cooling water (EN10), different waste fractions and disposal methods (EN22), or 'disturbed' and 'rehabilitated' land (MM01) are defined, it is impossible to assess and compare corporate performance on these aspects.

In relation to most of the 26 SLM indicators, good corporate reporting practice can be identified within the sample. Value provides a detailed overview of IUCN Red List species (EN15); African Rainbow Minerals presents comprehensive and clearly structured information on its impacts on biodiversity (EN11-14); Barrick Gold provides site-level information on waste generation EN22). Therefore, notwithstanding the general shortcomings identified above, current best practice suggests that significant improvements in SLM-reporting are clearly possible.

5. DISCUSSION AND CONCLUSION

5.1. Sustainable land management and the mining sector

Increased mainstreaming of corporate sustainability reporting has been identified in the mining sector, with more comprehensive accounts of corporate sustainability performance made publicly available. However, this is at best only partially reflected by the ways in which mining companies report on SLM practices. Information provided by mining companies in our sample showed a clear bias towards qualitative information and incomplete accounts, often neglecting unspecified parts of the companies' operations. Crucially, it is not possible to compare and benchmark SLM performance based on the information provided, confirming recent findings in the context of biodiversity reporting (Rimmel and Jonäll 2013; van Liempd and Busch 2013). A general observation is that data are normally highly aggregated, typically taking an investor's perspective and using the entire company as a reference point. Notable exceptions are companies that have published country-level or mine-level sustainability reports (e.g. Rio Tinto, Xstrata); nevertheless, highly aggregated information dominates. The GRI reporting format is arguably more suitable for global environmental problems such as climate change, but less so for a context-specific wicked problem such as land degradation, whereby contextual information is essential to evaluate corporate performance relating to aspects such as resettlements, destruction and restoration of habitats or the impacts of significant spills.

It should be noted that sustainability reporting has only recently emerged as a mainstream practice among large companies. Further progress in terms of dissemination and standardization can be expected to further improve reporting quality. Our analysis has shown that pockets of good reporting practices can be already identified with regard to most SLM-related performance indicators. Nevertheless, the upward harmonization that has been identified in terms of the comprehensiveness of reporting (Fortanier et al. 2011) has not yet led to sufficient standardization of the information that is provided. Consequently, there is a real risk that sustainability reports are reduced to public relations tools rather than being effective accountability tools (Barkemeyer et al. 2014). It remains to be seen whether current developments such as the emergence of integrated reporting (Eccles and Krzus 2010) or mandatory reporting in various countries and sectors (Eccles et al. 2012) will be able to transform sustainability reporting into a functioning accountability mechanism that enables stakeholders to actually evaluate corporate sustainability – and with it SLM – performance.

5.2. Implications and recommendations for the UNCCD

The implications of our findings for the UNCCD and progress towards land degradation neutrality are threefold. First, SLM is not embedded within the lexicon of the mining sector. To date, the UNCCD's focus on agriculture has resulted in neglect of the mining sector's potential to contribute towards UNCCD goals, leading to the development of parallel processes using alternative terminology to describe SLM practices. This has occurred despite mining's overlaps with other land based sectors such as agriculture, water and forestry. While our results demonstrate that companies are reporting to a high standard on their engagement in SLM, and that the sector is contributing positively

towards land degradation neutrality aspirations, SLM is not being addressed comprehensively within the sector. This is likely due to the umbrella nature of SLM and the presence of parallel or competing discourses on e.g. sustainable development or the green economy, which are more accessible to mining stakeholders.

Our analysis and disaggregation of company reports was both time consuming and complicated due to the various interpretations of SLM. We recognize that it will be difficult for country parties to the UNCCD that are expected to provide regular national reports on the progress made in implementing the UNCCD to make meaningful use of reports produced using the GRI Guidelines to identify where specific SLM actions are occurring. As such, knowledge and information on SLM activities in the mining sector are not flowing smoothly between the private sector and governments. In addition, while our findings enable identification of good reporting practices, challenges remain in identifying good SLM practices, both in specific contexts and at the necessary level of disaggregation for them to be useful. This could hinder identification of positive company actions that could be scaled-up, such that the potential contribution of the mining sector towards land degradation neutrality far outweighs its actual contribution.

Second, our findings suggest that the UNCCD needs to proactively engage with the various competing discourses on and motivations for SLM in order to initially raise awareness about land degradation neutrality, then to take steps towards the mainstreaming of SLM approaches within the mining sector. This would require dialogue with the International Commission on Mining and Metals (ICMM), the Business Council on Sustainable Development and other key bodies that bring together industry leaders to address sustainable development challenges. At the national level, such dialogue could be complemented with advocacy to national government stakeholders to encourage the establishment of institutional and policy conditions such as regulations or economic incentives that could contribute towards a more enabling context for SLM (cf. Akhtar-Schuster et al. 2011). For SLM to become more central to mining companies' agendas, it will be important to also bridge the gaps between legislation, regulation and enforcement. Given the key role of MNCs in the mining sector, and that our results indicate that the primary motivation for companies' engagement in SLM links to their desire to sustain their business in a cost-effective way within the boundaries of the relevant national laws, there is an opportunity to identify new partnerships that build upon and leverage from these drivers and motivations to further advance land degradation neutrality.

Finally, there is a need for the UNCCD to engage with the wide range of reporting and regulatory bodies in the mining sector such that good SLM practices from companies operating across the sector can be shared and can become more accessible and visible. Such efforts will be vital not just for the UNCCD's success but also in order that the Rio+20 outcome document *The Future We Want* might advance also towards its commitment (para.206) to 'strive to achieve a land degradation neutral world in the context of sustainable development'.

Wicked problems such as land degradation involve multiple stakeholders and are highly challenging to address. Our analysis of interview data and corporate sustainability reports suggests that the engagement of companies operating within the mining sector in SLM can play a key role in advancing the UNCCD's goals and in progressing towards land degradation neutrality. To date however, the potential of the sector has been overlooked. We have identified important concerns

about the type of information provided (qualitative narratives, aggregated, without context), highlighted that a limited amount of SLM-related information is reported, despite company engagement in SLM practices, and have revealed a lack of transparency and comparability between company reports. For companies to harness their potential to demonstrate to their shareholders their engagement in SLM, requires the reporting of both qualitative and quantitative data, sufficiently disaggregated to an operational level, situated within information about the broader context in which the information was gathered. Some companies are beginning to report in this way. It is vital that lessons from these top runners are more widely shared. Such efforts would enhance transparency and comparability between companies and over time, whilst also providing national governments with more usable information to report to the UNCCD, on efforts made in both implementing SLM and in moving towards land degradation neutrality.

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Appendix 1: Interview participants

ID	Organization	Country	Type	Position
Corp1	Mining Company	Peru	Corporate	Head of Social Responsibility
Corp2	Mining Company	Zambia	Corporate	Community Development Coordinator
Corp3	Mining Company	Zambia	Corporate	Project coordinator of conservation farming program
Corp4	Mining Company	Zambia	Corporate	Senior Supervisor of Community Engagement Programme
Corp5	Mining Company	Peru	Corporate	Sustainability Manager (project-level)
NGO1	Environmental NGO	Zambia	NGO	Policy Officer
NGO2	Environmental NGO	Zambia	NGO	Coordinator of Community Engagement Programme
NGO3	Environmental NGO	Zambia	NGO	Wetlands Officer
Aca1	Academic	UK	Academic	Lecturer
Aca2	Academic	UK	Academic	Lecturer
Gov1	Ministry of Environment	Peru	Government	Coordinator of Soil and Water Management
Gov2	Ministry of Environment	Peru	Government	SLM Coordinator

Appendix 2: Mining company sustainability reports included in the content analysis

	Company	Resources (Peru & Zambia)	Peru	Zambia	SR	GRI	SR from	first GRI	GRI Application Level of most recent report
1	African Rainbow Minerals	Copper	0	1	1	1	2007	2009	A+
2	Anglo American plc	Copper	1	0	1	1	2007	2007	A+
3	Antofagasta	Copper, Gold	1	1	1	1	2007	2007	A+
4	Barrick Gold	Copper, Gold	1	1	1	1	2005	2005	A+
5	BHP Billiton	Copper	1	0	1	1	2005	2005	A+
6	Buenaventura	Gold, Silver, Copper, Zinc	1	0	1	0	2012	--	
7	Candente Copper	Gold, Copper, Molybdenum	1	0	0	0	--	--	
8	Chinalco	Copper, Silver	1	0	0	0	--	--	
9	ENRC	Copper	0	1	1	1	2011	2011	N/A
10	First Quantum Minerals	Copper, Gold	1	1	1	0	2010	--	
11	Freeport-McMoRan (FCX)	Copper, Gold	1	0	1	1	2008	2009	A+
12	Gemfields	Emeralds, Amethyst	0	1	0	0	--	--	
13	Glencore	Copper, Cobalt, Gold, Zinc	1	1	1	1	2010	2010	A+
14	Glencore Xstrata	Copper, Cobalt, Gold, Zinc	1	1	1	1	2012	2012	A+
15	Gold Field Limited	Gold	1	0	1	1	2006	2010	A+
16	Grupo Mexico	Copper	1	0	1	0	2006	2006	A+
17	H and S Mining	Copper	0	1	0	0	--	--	
18	Hochschild	Gold, Silver	1	0	0	0	--	--	
19	Metorex Pty Ltd	Copper	0	1	0	0	--	--	
20	Milpo	Zinc, Copper, Silver, Gold	1	0	1	1	2008	2011	A
21	Nava Bharat	Coal	0	1	0	0	--	--	
22	Newmont Mining Corporation	Copper, Gold, Silver	1	0	1	1	2007	2007	A+
23	Rio Tinto	Copper, Gold, Nickel	1	0	1	1	2008	2011	A+
24	Shougang Corporation	Iron	1	0	0	0	--	--	
25	Silver Wheaton Corporation	Silver	1	0	0	0	--	--	
26	Teck Resources	Copper, Zinc	1	0	1	1	2001	2005	A+
27	Vale SA	Copper, Cobalt	1	1	1	1	2006	2006	A+
28	Vedanta Resources	Copper, Cobalt	0	1	1	1	2009	2010	A+
29	Xstrata	Copper, Cobalt, Gold, Zinc	1	1	1	1	2006	2006	A+
30	Zijin Mining Group Company	Copper, Gold, Non-ferrous Metals	1	0	1	0	--	--	

Appendix 3: SLM-relevant GRI indicators

Relevant G3.1 Indicators in the Context of SLM			
Nb	Indicator	Title	Category
1	EN11	Location and size of land owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas.	Biodiversity
2	EN12	Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas.	Biodiversity
3	EN13	Habitats protected or restored.	Biodiversity
4	EN14	Strategies, current actions, and future plans for managing impacts on biodiversity.	Biodiversity
5	EN15	Number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk.	Biodiversity
6	MM02	The number and percentage of total sites identified as requiring biodiversity management plans according to stated criteria, and the number (percentage) of those sites with plans in place.	Biodiversity
7	EN25	Identity, size, protected status, and biodiversity value of water bodies and related habitats significantly affected by the reporting organization's discharges of water and runoff.	Biodiversity/ Water
8	EC01	Direct economic value generated and distributed, including revenues, operating costs, employee compensation, donations and other community investments, retained earnings, and payments to capital providers and governments.	Economic
9	EN28	Monetary value of significant fines and total number of non-monetary sanctions for non-compliance with environmental laws and regulations.	Economic
10	EN30	Total environmental protection expenditures and investments by type.	Economic
11	PR09	Monetary value of significant fines for non-compliance with laws and regulations concerning the provision and use of products and services.	Economic
12	MM08	Number (and percentage) of company operating sites where artisanal and small-scale mining (ASM) takes place on, or adjacent to, the site; the associated risks and the actions taken to manage and mitigate these risks.	Economic/ Biodiversity
13	MM06	Number and description of significant disputes relating to land use, customary rights of local communities and Indigenous Peoples.	Social
14	MM09	Sites where resettlements took place, the number of households resettled in each, and how their livelihoods were affected in the process.	Social
15	MM10	Number and percentage of operations with closure plans.	Social
16	MM7	The extent to which grievance mechanisms were used to resolve disputes relating to land use, customary rights of local communities and Indigenous Peoples, and the outcomes.	Social
17	SO01	Percentage of operations with implemented local community engagement, impact assessments, and development programs.	Social
18	SO09	Operations with significant potential or actual negative impacts on local communities.	Social
19	MM01	Amount of land (owned or leased, and managed for production activities or extractive use) disturbed or rehabilitated.	Soil/ Social
20	MM03	Total amounts of overburden, rock, tailings, and sludges and their associated risks.	Soil/ Water/ Waste
21	EN22	Total weight of waste by type and disposal method.	Waste
22	EN23	Total number and volume of significant spills.	Waste
23	EN08	Total water withdrawal by source.	Water

24	EN09	Water sources significantly affected by withdrawal of water.	Water
25	EN10	Percentage and total volume of water recycled and reused.	Water
26	EN21	Total water discharge by quality and destination.	Water

Appendix 4: Coverage of SLM-relevant GRI indicators

	Core	Core	Add	Add	Core	Core	Add	Add	Add	Core	Core	Core	Add	Core	Add	Core	Core
Company Name	**EC1**	**EN8**	**EN9**	**EN10**	**EN11**	**EN12**	**EN13**	**EN14**	**EN15**	**EN21**	**EN22**	**EN23**	**EN25**	**EN28**	**EN30**	**SO1**	**PR9**
Anglo American	100%	100%	67%	67%	100%	100%	100%	100%	67%	100%	100%	100%	83%	100%	67%	100%	100%
Antofagasta	100%	100%	100%	100%	100%	100%	100%	100%	60%	100%	100%	100%	60%	100%	40%	100%	40%
ARM	100%	100%	80%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	40%	100%	100%
Barrick	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
BHP Billiton	83%	100%	50%	83%	100%	100%	83%	100%	17%	100%	100%	100%	33%	100%	17%	83%	83%
ENRC	100%	100%	0%	0%	0%	50%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FCX	100%	100%	67%	100%	100%	100%	33%	67%	0%	100%	100%	100%	33%	100%	67%	100%	100%
Glencore	100%	100%	0%	100%	100%	100%	50%	50%	0%	100%	100%	100%	0%	100%	0%	100%	100%
GlencoreXstrata	100%	100%	0%	100%	100%	100%	0%	0%	0%	100%	100%	100%	0%	100%	0%	100%	100%
Gold Fields	100%	100%	80%	80%	100%	100%	80%	80%	80%	100%	100%	100%	80%	100%	80%	100%	100%
Grupo Mexico	100%	100%	17%	100%	83%	100%	83%	83%	83%	83%	100%	83%	17%	83%	100%	100%	83%
Milpo	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Newmont Mining	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	33%	100%	33%
Rio Tinto	100%	100%	0%	0%	100%	100%	0%	0%	0%	100%	100%	100%	0%	100%	0%	100%	100%
Teck Resources	100%	100%	25%	100%	100%	100%	100%	100%	0%	100%	100%	100%	0%	100%	0%	100%	100%
Vale	100%	100%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%	100%	100%	100%	100%
Vedanta	100%	100%	33%	67%	100%	100%	33%	33%	33%	100%	100%	67%	0%	100%	33%	67%	67%
Xstrata	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	25%	100%	100%
TOTAL SAMPLE	**99%**	**100%**	**54%**	**83%**	**94%**	**97%**	**76%**	**79%**	**52%**	**94%**	**94%**	**92%**	**48%**	**94%**	**45%**	**92%**	**84%**

Appendix 4 (continued): Coverage of SLM-relevant GRI indicators

	SECTOR SUPPLEMENT MINING & METALS								AVERAGE COVERAGE ACROSS 26 SLM INDICATORS			
Company Name	**MM01**	**MM02**	**MM03**	**MM06**	**MM07**	**MM08**	**MM09**	**MM10**	**AVERAGE** (CORE INDICATORS)	**AVERAGE** (ADDITIONAL INDICATORS)	**AVERAGE** (SUPPLEMENT)	**OVERALL**
Anglo American	100%	100%	100%	100%	100%	100%	100%	100%	100.0%	78.6%	100.0%	94.0%
Antofagasta	100%	80%	100%	100%	80%	80%	80%	100%	94.0%	80.0%	90.0%	88.8%
ARM	60%	80%	20%	80%	80%	80%	80%	60%	100.0%	88.6%	67.5%	86.4%
Barrick	100%	100%	100%	100%	100%	100%	100%	100%	100.0%	100.0%	100.0%	100.0%
BHP Billiton	83%	83%	83%	83%	67%	83%	83%	83%	95.0%	54.8%	81.3%	79.3%
ENRC	0%	0%	0%	0%	0%	0%	0%	0%	25.0%	28.6%	0.0%	18.0%
FCX	100%	100%	100%	100%	100%	100%	100%	100%	100.0%	52.4%	100.0%	86.7%
Glencore	100%	100%	100%	100%	100%	100%	100%	100%	100.0%	28.6%	100.0%	80.0%
GlencoreXstrata	100%	100%	100%	100%	100%	100%	100%	100%	100.0%	14.3%	100.0%	76.0%
Gold Fields	80%	80%	80%	80%	80%	80%	80%	80%	100.0%	80.0%	80.0%	88.0%
Grupo Mexico	67%	33%	50%	83%	67%	0%	67%	67%	91.7%	69.0%	54.2%	73.3%
Milpo	100%	100%	100%	50%	50%	50%	50%	50%	100.0%	100.0%	68.8%	90.0%
Newmont Mining	100%	100%	100%	100%	100%	100%	100%	100%	93.3%	90.5%	100.0%	94.7%
Rio Tinto	100%	100%	100%	100%	100%	100%	100%	100%	100.0%	0.0%	100.0%	72.0%
Teck Resources	100%	100%	100%	100%	100%	100%	100%	100%	100.0%	46.4%	100.0%	85.0%
Vale	100%	100%	100%	100%	100%	100%	100%	100%	100.0%	85.7%	100.0%	96.0%
Vedanta	67%	67%	67%	33%	33%	33%	67%	67%	90.0%	33.3%	54.2%	62.7%
Xstrata	100%	100%	100%	100%	75%	100%	100%	100%	100.0%	89.3%	96.9%	96.0%
TOTAL SAMPLE	**86%**	**85%**	**83%**	**84%**	**80%**	**78%**	**84%**	**84%**	**93.8%**	**62.2%**	**82.9%**	**81.5%**