



# Sustainability accounting and reporting in the mining industry: current literature and directions for future research



Sumit Lodhia <sup>a,\*</sup>, Nadia Hess <sup>b</sup>

<sup>a</sup> Centre for Accounting, Governance and Sustainability, University of South Australia Business School, GPO Box 2471, Adelaide, South Australia 5001, Australia

<sup>b</sup> School of Law, University of South Australia Business School, Adelaide, Australia

## ARTICLE INFO

### Article history:

Received 21 May 2014

Received in revised form

28 August 2014

Accepted 28 August 2014

Available online 10 September 2014

### Keywords:

Sustainability accounting and reporting

Social

Environmental

Management

Communication

Mining

## ABSTRACT

This paper explores sustainability accounting and reporting in the mining industry through an analysis of the literature in the *Journal of Cleaner Production* from 2004 to 2013. It complements the special issue papers on the theme of sustainability accounting and reporting by discussing prior literature on this aspect in this journal. The research design involved a manual analysis of all articles where a two stage screening process was undertaken to ascertain: firstly, whether an article was based on the mining context; and secondly, where it addressed sustainability accounting and reporting. It was found that while sustainability accounting and reporting practices are evolving, progress is slow. Mining companies were not fully accountable for their sustainability impacts, a situation that was exacerbated in a developing country context. However, some positive developments were also observed such as partnerships with NGOs and improving practices in specific contexts. Moreover, a number of these studies provided practical recommendations for improving sustainability accounting and reporting in the mining industry. A need for effective sustainability management and credible reporting is recommended for mining companies in their transition to sustainability. After discussing the state of the existing literature, future research opportunities are highlighted. This paper contributes to the literature and practice by providing an understanding of current mining sustainability accounting and reporting practices, assessed through the academic literature. Future research directions that have the potential to provide an understanding of sustainability accounting and reporting issues not addressed in the current literature are also outlined within the context of the mining industry. These include new developments such as integrated reporting, climate change accounting and water accounting, coupled with an emphasis on sustainability reporting and auditing, and consideration of a range of stakeholders, social issues and differing contexts.

© 2014 Elsevier Ltd. All rights reserved.

## 1. Introduction

Sustainability accounting and reporting is the organisational response to the management and reporting of its social and environmental issues (Bebbington et al., 2014; Burritt and Schaltegger, 2010; Gray et al., 2014; Schaltegger et al., 2006). It has risen to prominence in recent times due to the increasing emphasis on sustainability (social and environmental) issues in the modern day globalised society. Whilst sustainability accounting and reporting research has a similar goal to business and sustainability oriented literature (for example, subject matters such as corporate social

responsibility and business ethics), and often its researchers draw upon this research, an emphasis on the management and reporting aspects of sustainability differentiates the accounting literature from others areas of research inquiry into sustainability. The management and reporting dimensions are the focus of the current study, guiding the analysis of existing literature in this paper.

The mining industry requires effective sustainability accounting and reporting in order to transition to sustainability. It is an industry where social and environmental issues are critical and stakeholder pressures are paramount (Lodhia, 2007). Companies in the industry need to provide evidence of their social and environmental responsibility to their stakeholders, and sustainability accounting and reporting is an approach that has been increasingly utilised by them (Jenkins and Yakovleva, 2006; Lodhia, 2012b; Peck and Sinding, 2003). Pellegrino and Lodhia (2012) suggest that in

\* Corresponding author.

E-mail addresses: [Sumit.Lodhia@unisa.edu.au](mailto:Sumit.Lodhia@unisa.edu.au) (S. Lodhia), [Nadia.Hess@unisa.edu.au](mailto:Nadia.Hess@unisa.edu.au) (N. Hess).

addition to companies, mining industry associations are also increasingly involved in the reporting of social and environmental issues in the industry. Sustainability accounting and reporting should be matched by effective performance in relation to social and environmental matters (Bebbington et al., 2014; Gray et al., 2014; Schaltegger et al., 2006).

The purpose of this paper is to analyse the existing literature in the *Journal of Cleaner Production* on sustainability accounting and reporting in relation to the mining industry<sup>1</sup>. It adds to the existing reviews of sustainability accounting and reporting literature but provides a new perspective to such reviews. This study differs from the more general reviews of sustainability accounting and reporting (such as for example, Hahn and Kühnen, 2013) as it focuses on a specific context.

In line with the special issue, emphasis is within the context of the mining industry. The overall goal is to take stock of the existing literature in order to identify what has been done and to use this review as a basis for identifying areas that require further research investigation.

The *Journal of Cleaner Production* has contributed extensively to literature on sustainability in the mining industry, evident from a number of special issues on this matter (including the current issue). There have also been specific studies in the general issues of this Journal that have addressed sustainability in mining. The Journal has a subject editor specifically for mining, highlighting the importance given to literature on this industry. Within this broad literature, there are a number of papers that are based on sustainability accounting and reporting. This subject matter is a theme for the current special issue. These observations can be contrasted with other publication outlets for sustainability accounting and reporting research (including multi-disciplinary journals) where the mining industry has not featured prominently, generally, and especially in relation to special issues. Most of these journals focus on sustainability accounting and reporting overall and have limited literature into the intricacies and complexities of the mining industry's practices per se. These developments suggest that the *Journal of Cleaner Production* is an ideal context for undertaking a longitudinal review of sustainability accounting reporting in the mining industry when compared to other publication outlets.

Section two describes the concept of sustainability accounting and reporting in detail. The context, theories and methods used in prior literature on sustainability accounting and reporting are discussed. Section three in turn outlines the research design used for this study. Section four discusses prior *Journal of Cleaner Production* literature on sustainability accounting and reporting in the mining industry. The internal management aspects are discussed before attention shifts to sustainability reporting studies. A special issue on mining in this Journal is also mentioned because it emphasises the management and reporting of sustainability. The overall literature is then analysed, leading to section five where future research opportunities are identified. Section six concludes the paper.

## 2. Sustainability accounting and reporting

Sustainability accounting and reporting has its roots in the traditional accounting practice where management accounting involves internal organisational practices that assist in management of an organisation and financial reporting provides a financial account of organisational performance (Burrill and Schaltegger,

2010; Lodhia, 2013). Thus, in line with the traditional accounting practice, sustainability accounting and reporting includes an internal component which requires management of sustainability issues, often referred to as sustainability management, and an external reporting element, referred to as sustainability reporting (Bebbington et al., 2014; Gray et al., 2014). Conversely, Schaltegger and Wagner (2006) use the terms sustainability accounting and sustainability reporting; whereby the former refers to the management of sustainability issues and the latter, the formal reporting of these issues. It is within these broad parameters that the practice of sustainability accounting and reporting has been analysed in the academic literature.

Whilst the focus of sustainability accounting and reporting literature has been on corporations, other organisations such as Governments and Non-Governmental Organisations could provide a useful context for an analysis of the use of sustainability management systems and/or sustainability reporting (Lodhia et al., 2012; Lodhia and Jacobs, 2013; O'Dwyer, 2002; O'Dwyer et al., 2005). Similarly, the focus on sustainability accounting and reporting has moved on from an extensive emphasis on the developed part of the world to cover developing nations (see for example, Islam and Deegan, 2008; Lodhia, 1999, 2003, 2004a).

The notion of accountability provides the foundations for sustainability accounting and reporting (Gray et al., 2014). In essence, an organisation is accountable to both its internal and external stakeholders, and sustainability accounting and reporting enables the organisation to provide evidence of its accountability. Similarly, theories have been postulated to explain sustainability accounting and reporting. Prominent among these are legitimacy theory and stakeholder theory while new institutional sociology has also had an increasing use in recent times.

Legitimacy theory (Deegan, 2002; Dowling and Pfeffer, 1975; Lindblom, 1993) states that for organisations to survive, they need to legitimise their existence to society and sustainability accounting and reporting enables them to be legitimate. Conversely, stakeholder theory (Clarkson, 1995; Donaldson and Preston, 1995; Freeman, 1984; Roberts, 1992; Ullmann, 1985) highlights the various stakeholders that an organisation needs to manage in order to legitimise its existence.

Another theory that has had an increasing use is new institutional sociology (Bebbington et al., 2009; Di Maggio and Powell, 1983; Larrinaga-González, 2007; Meyer and Rowan, 1977) which states that coercive (regulatory), normative (professionalisation and networks) and mimetic (replicating other successful practices) pressures lead to organisational conformity in the adoption of sustainability accounting and reporting. A more recent development is that of reputation risk management (Bebbington et al., 2008; Hogan and Lodhia, 2011; Panchal-Arora and Lodhia, 2013) which emphasises organisational reputation and outlines strategies that can be used to manage an organisation's reputational risk through sustainability accounting and reporting.

A variety of research methods have been used to explore sustainability accounting and reporting practices. These methods primarily include content analysis for reports (see for example, Jenkins and Yakovleva, 2006; Peck and Sinding, 2003; Roberts, 1992) and websites (Lodhia, 2010, 2012b), interviews (see for example, O'Dwyer, 2002) and surveys (see for example, O'Dwyer et al., 2005). Other methods that have been used, albeit in a small number of studies, include experiments (see for example, Milne and Patten, 2002) and ethnographic methods (see for example, Day, 2007).

## 3. Research design

Prior literature on sustainability accounting and reporting in the mining industry published in the *Journal of Cleaner Production* from

<sup>1</sup> Even though the focus of this paper is on the *Journal of Cleaner Production*, the relevance of this paper extends beyond the readership of this Journal. This is due to the extensive literature on mining within the Journal, as well as the broader interest that a special issue attracts.

2004 to 2013 was analysed. As the focus was on contemporary research, the most recent decade was regarded as appropriate for obtaining a longitudinal assessment of existing research. This provides sufficient depth to enable an understanding of what has been done but also to assess what could be done in the future.

Emphasis in the analysis of the *Journal of Cleaner Production* literature was on the twin aspects of the management and the reporting of sustainability issues as described in the preceding section so that the investigation of sustainability accounting and reporting was consistent with that described in the literature. The intention was to establish the Journal's contribution to the development of sustainability accounting and reporting research in the mining industry.

The study involved a labour intensive, manual analysis of *Journal of Cleaner Production* articles with involvement of this paper's authors in this process. Every article published in the Journal from 2004 to 2013 was downloaded. This approach was used instead of an electronic search on sustainability-related terms as it was possible that depending on the search terms, certain articles could have been overlooked.

A two stage screening process was used to identify the appropriate articles for the review. Initially, both authors undertook this screening independently. They then compared their resulting articles and addressed any possible discrepancies in the screening. This thorough process ensured that the research was rigorous. It also ensured that research validity and reliability was guaranteed.

In the first instance, articles that did not include the mining context were excluded. Secondly, the remaining articles were read briefly and an assessment was made as to whether they addressed sustainability accounting and reporting issues. This led to a final analysis of the remaining articles which were read in detail and their key themes are discussed below.

#### 4. Journal of Cleaner Production literature

There have been a number of studies in the *Journal of Cleaner Production* that discuss the management aspects of sustainability.

Through a short survey, [Driussi and Jansz \(2006\)](#) investigated the current pollution minimisation practices undertaken by four Australian mining companies (BHP Billiton, BlueScope Steel, Newmont Mining Corporation, and AngloGold Australian) to determine the improvements that had been made, as well as the policies that had been implemented, by the companies. The authors found that the four companies used Australian and International codes of practice and standards, as well as company policies, as a framework to develop pollution minimisation strategies. The study concluded that whilst Australian mining companies appeared to be committed to improving the sustainability of their operations as well as minimising their environmental impact, there was still room for improvement.

In an opinion piece, [Whitmore \(2006\)](#) highlighted that the idea of 'new, sustainable mining' coined by the mining industry was in fact not all that different to the mining practices of the past. He considered the various sustainability initiatives in the mining industry (which impact sustainability accounting and reporting practices) and the 2001 London Declaration. The author determined that the Declaration contained a series of half-truths, exposing the fallacy of sustainable mining. The paper discussed four key half-truths: the supposed need for more minerals from every mine, the claim that mining catalyses development, the belief that technical fixes can solve every problem, and that the main opposition to mining comes from ignorant communities and NGOs. [Whitmore \(2006\)](#) concluded that from the perspective of the mine affected communities, nothing seemed to have changed; the attempts by the mining industry to 'green-wash' itself had failed.

Other studies on the management of sustainability issues in the mining industry have addressed the developing part of the world and focused on specific issues such as water management.

[Kumah \(2006\)](#) discussed the environmental performance of the gold mining industry in developing countries by undertaking a case study on the gold mining industry in Ghana. He posited that whilst the increase in gold mine investment is needed to propel economies, an expansion in operations is often associated with negative environmental and socioeconomic issues, including reports of human rights abuses by the major gold corporations. The author concluded that in spite of the rich natural resources base of many developed countries, this had failed to materialise into significant benefits for the local communities. The paper provided a series of recommendations in reference to the Brundtland Report, with the focus of a higher level of government involvement – through changes to economic policy, and making environmental and social reporting mandatory – to helping achieve economic prosperity and social justice for local communities.

[Kemp et al. \(2010\)](#) highlighted the points of disconnection between technical, scientific, and engineering based approaches to water management on the one hand, and human rights perspectives on the other. They discussed the lack of reporting in relation to the right to water in the mining industry. A multi-disciplinary approach was suggested as the way forward, one where social science has as much importance as engineering and natural science.

Some of the studies that have focused on the reporting of sustainability issues in the mining industry have emphasised the development of sustainability indicators, highlighted the use of the web as a communication medium, addressed specific issues such as climate change policy and observed reporting in the developing part of the world.

[Azapagic \(2004\)](#) developed a comprehensive framework of sustainability indicators specifically tailored for the minerals industry. The framework comprises economic, environmental, social and integrated indicators which can be used both internally for sustainable management as well as externally, for sustainable reporting and stakeholder engagement. The indicators are consistent with the GRI framework while additional sector-specific indicators to reflect the unique characteristics of the minerals industry were also developed.

[Lodhia \(2012b\)](#) used the media richness framework to explore the extent of the use of the web as a medium for the social and environmental communication in the context of the Australian mining industry. Through the use of a case study methodology that incorporated interviews and website analysis, the usage of the web by three Australian mining companies was analysed. The study found that each of the companies recognised the benefits of the web, and that each company did use the web for social and environmental communication. However, there was variation in the features used by the three companies. The study concluded that ostensibly the full potential of the web is not utilised. There is scope for further studies to investigate why the developments in web based technology have not been comprehensively adopted by mining corporations.

[Pellegrino and Lodhia \(2012\)](#), through a content analysis of documents and website information, sought to establish whether climate change and impending carbon pricing requirements had an impact on the climate change disclosure of the Australian mining industry. They explored the disclosure practices of two leading mining companies, BHP Billiton and Rio Tinto, as well as two key industry bodies, the Minerals Council of Australia (MCA) and the Australian Coal Association (ACA). Legitimacy theory was used to determine the motivations for the voluntary disclosures by the mining industry. The study concluded that both the companies and

the industry associations used voluntary disclosure on sustainability issues in a way to maintain their legitimacy and to ensure the continuation of their social licence to operate. It was found that the companies focused on their own performance while the industry associations looked at broader policy issues such as the impending carbon pricing requirements. The unique contribution of this study is the importance of focussing at the industry level for critical issues such as climate change whereby both micro (companies) and macro (industry associations) levels of analysis was undertaken.

Murguía and Böhling (2013) discussed the effectiveness of sustainability reporting in the mining industry with a case study on the Bajo de La Alumbrera mine, Argentina. The GRI guidelines were used for the analysis of reporting and stakeholder theory provided the overriding theoretical framework for this study. The authors found that whilst the sustainability report had a high compliance with the GRI guidelines in relation to the quantity of disclosure, the overall quality of the disclosures was poor. The study found that the information provided was not precise enough to fulfil the GRI requirements, especially in relation to the Environmental category. The authors concluded that when sustainability reports contain low quality data in relation to contentious issues, the credibility of such reports can be questioned. It was also concluded that if stakeholder expectations are only managed, as opposed to stakeholders being engaged within the reporting process, conflicts tend to continue. This paper contributed to the literature by highlighting how sustainability reporting can play an adverse role and exacerbate conflicts if the information reported is not of a high quality.

Mining literature in the *Journal of Cleaner Production* has also addressed specific aspects of sustainability accounting and reporting; with a focus on auditing and the Non-Governmental sector.

Kemp et al. (2012) challenged the current audit culture for corporate social responsibility. Semi-structured interviews were conducted with 16 global mining companies, an international industry organisation, and stakeholders from academia and non-government organisations. It was found that internal audits have limited value in their ability to stimulate internal engagement. This was because the process relies on auditors generating performance data against preselected indicators and the organisations personnel are regarded as subjects of the audit rather than participants in the process. Alternative approaches to the traditional audit culture were then suggested.

McDonald and Young (2012) explored the 30 year journey taken by mining giant Alcoa of Australia in their collaborative relationship with the not for profit organisation, Greening Australia. Through the use of interviews and documents, the research explored why the relationship was formed and assessed the reasons for its longevity. This paper offered a model of corporate social responsibility by introducing key variables that inform the longevity of a successful environmental partnership including, government support, employee support, interaction or engagement opportunities, and the need for effective evaluation when planning and monitoring initiatives.

In a special issue of the *Journal of Cleaner Production* on mining, legal policy and sustainability, a number of papers related to sustainability accounting and reporting were discussed. The editorial by MacDonald (2006) provided an overview of the environmental management tools that can be employed to assist industry players in improving the environmental, economic and ethical performance of the mining industry. MacDonald highlighted a recurring theme in each of the papers; the negative image associated with the mining industry and serious efforts that have been made to remove this stigma and to move towards maintaining ethically and socially acceptable practices. Newbold (2006) examined the application of ISO 14001 in a Chilean mining context and critiqued

the process of obtaining ISO certification for three mining operations. Evangelinos and Oku (2006) examined the corporate environmental management practices of the minerals mining operations in the Greek Cyclades islands through interviews and content analysis of various documents. Both positive and negative impacts of mining were discussed, and this led the authors to suggest that mining operations in this context should consider win–win situations (for the company and the stakeholders) in regard to sustainable operations. Jenkins and Yakovleva (2006) investigated corporate social responsibility by examining the social and environmental disclosure trends in the mining industry through a chronological analysis of the reporting of the top 10 global mining companies. Their findings suggested that whilst such disclosure has increased and has become more sophisticated, reporting companies can be classified according to a ‘leaders to laggards’ continuum. ‘Mature reporters’, ‘adolescents’ and ‘infants’ were terms used to categorise the variation in these companies’ social and environmental reporting (Jenkins and Yakovleva, 2006). The authors suggested that strong leadership and cooperation from the leading companies was needed to support the laggards of the industry.

Table 1 summarises the major published works on sustainability accounting and reporting (in Mining) in the *Journal of Cleaner Production* from 2004 to 2013. In line with Section 2, it also outlines the theories and methods used in these studies.

These studies on the management and reporting of sustainability in the mining industry in the *Journal of Cleaner Production* have made important contributions to both the literature as well as to the practical understanding of mining company practices. The findings of the various studies suggest that the transition to sustainability in this industry has been somewhat slow and that there is scope for further improvement. Concerns have been raised about mining operations in the developing part of the world whilst Government and NGO involvement is perceived as critical for transforming business practices. Other suggestions for improvement in practice focus on improving sustainability management practices, precise indicators for reporting and a need to make reporting credible, alternative approaches to reporting through new media, and involvement of stakeholders through their engagement with mining companies.

The overview of the major literature on sustainability accounting and reporting published in this Journal also highlights a number of interesting trends. Studies have focused on the developed and developing part of the world, with both large and small miners being analysed. The methods range from opinion pieces to surveys, interviews and content analysis. Both management and reporting issues are considered in the literature. The analysis of the existing literature also reveals that the coverage of environmental issues is more extensive than social issues. A majority of the studies have focused on corporations.

There is a lack of theorisation in a majority of the studies as indicated in Table 1. In some cases, theories are not applicable to the study but other studies could benefit from a more extensive theoretical underpinning to explain the findings. As discussed earlier, legitimacy and stakeholder theories have been extensively used in prior sustainability accounting and reporting while newer perspectives such as reputation risk management and new institutional sociology are emerging. The benefit of researchers working in a multi-disciplinary environment with publication outlets such as *Journal of Cleaner Production* is that they could also “borrow” theories from other disciplines such as sociology and even the environmental and social sciences. There is indeed a need for “rich” theoretical insights to explain the intricacies of sustainability accounting and reporting and a need to go beyond the standard theoretical lens (Lodhia and Jacobs, 2013).



**Table 1**  
Sustainability accounting and reporting literature in the *Journal of Cleaner Production*.

Title (in order of appearance)	Authors	Theory	Methods	Significant findings
Pollution minimisation practices in the Australian mining and minerals processing industries	Driussi and Jansz (2006)	None	Survey	Current pollution minimisation practices by four Australian mining companies follow Australian and internal guidelines but there is room for improvement.
The emperors new clothes: Sustainable mining?	Whitmore (2006)	None	Opinion piece	“New Sustainable Mining” is no different from past practices.
Sustainability and gold mining in the developing world	Kumah (2006)	None	Case study	Gold mining in the developing world does not benefit local communities.
Mining, water and human rights: Making the connection	Kemp et al. (2010)	None	Content analysis	Social science and natural science based approaches to water management are needed for the mining industry.
Developing a framework for sustainable development indicators for the mining and minerals industry	Azapagic (2004)	None	Framework development	A framework comprising economic, social, environmental and integrated indicators is developed specifically for the mining industry.
Web based social and environmental communication in the Australian minerals industry: an application of media richness framework	Lodhia (2012b)	Media richness framework	Interviews, website analysis	The full potential of the web is not utilised for sustainability communication in the Australian mining industry.
Climate change accounting and the Australian mining industry: Exploring the links between corporate disclosure and the generation of legitimacy	Pellegrino and Lodhia (2012)	Legitimacy theory	Content analysis	Voluntary disclosure is used by both Australian mining companies and industry associations to legitimise their existence in light of impending carbon pricing requirements.
Sustainability reporting on large-scale mining conflicts: the case of Bajo de la Alumbrera, Argentina	Murguía and Böhling (2013)	Stakeholder theory	Case study	With reference to mining in a developing nation, sustainability reporting can play an adverse role and create conflicts if information is not of a high quality.
Corporate social responsibility, mining and “audit culture”	Kemp et al. (2012)	None	Interviews	The current audit culture for corporate social responsibility for global mining has limited value.
Cross-sector collaboration shaping corporate social responsibility best practice within the mining industry	McDonald and Young (2012)	None	Interviews, document analysis	Through a study of collaboration between an Australian mining company and an NGO, model for successful partnerships is developed.
Editorial. Section 1: environmental management, legal and policy issues in the mining industry	MacDonald (2006)	None	Editorial	Environmental management can be used by the mining industry to improve its performance and image.
Chile's environmental momentum: ISO 14001 and the large-scale mining industry – case studies from the state and private sector	Newbold (2006)	None	Case study	Critiques the ISO certification by mining companies in Chile.
Corporate environmental management and regulation of mining operations in the Cyclades, Greece	Evangelinos and Oku (2006)	None	Interviews, document analysis	Mining operations in the developing context should consider win–win situations for a company and its stakeholders.
Corporate social responsibility in the mining industry: Exploring trends in social and environmental disclosure	Jenkins and Yakovleva (2006)	None	Content analysis	Corporate social responsibility reporting by 10 global mining companies can be classified into the leaders-laggards continuum.

There are a number of areas of future research on sustainability accounting and reporting that can be undertaken in the mining industry. There is considerable scope for further research in this context and some of these are addressed in this special issue. Future research opportunities, which address some of the gaps in the literature highlighted here, and highlight new avenues for research, are discussed next.

## 5. Future research opportunities

There are a number of worthwhile pursuits in sustainability accounting and reporting research within the context of the mining industry. Some of these issues stem from the review of articles in the *Journal of Cleaner Production*. Other areas of research include contemporary sustainability accounting and reporting matters and these have been applied to the mining industry context. As discussed earlier in the paper, the focus is primarily on the *Journal of Cleaner Production*, due to its extensive emphasis on the mining industry. However, these areas of research could easily apply to other journals and where similar work has been already undertaken; these are identified in this Section.

Research can be undertaken in relation to contemporary issues such as integrated reporting, climate change and water accounting. The communication media for reporting, the auditing aspect of sustainability accounting and reporting, and the role of stakeholders and their relationship with the mining industry are also areas worth investigating. Studies do not have to be merely restricted to the developed part of the world and should address

the impact of mining in developing and underdeveloped countries. Similarly, studies should move beyond the corporate focus and explore other parties that have a role in sustainability accounting and reporting in the mining industry. Social issues should also be considered in conjunction with environmental issues. Finally, the regulatory aspects of sustainability accounting and reporting in the mining industry require the attention of researchers.

Whilst sustainability reporting research has been dominant in both academic studies as well as in practice, a new concept has emerged that focuses on integrating the various strands of reporting. It has been highlighted that existing sustainability reporting practices function in isolation of financial reporting and therefore, do not have a significant impact on business strategy and operations. Integrated reporting (Adams, 2013; IIRC, 2013), has been proposed as a new form of reporting that integrates economic, social and environmental information in a concise format, and enables a breakdown of the “silos” in an organisation. It is hoped that such reporting is accompanied by integrated thinking whereby integrated strategy, operations and performance provide the basis for an organisation to manage its economic, social and environmental matters.

The International Integrating Reporting Council (IIRC) has recently been formed to provide guidance for the development of integrated reporting. However, the IIRC's pilot case studies do not have an extensive involvement of mining companies. The adoption and impact of integrated reporting on mining companies is therefore a research inquiry that needs to be addressed. Studies could seek to content analyse the social, environmental and economic

information disclosed by mining companies and assess their extent of integration. Surveys and interviews of corporate executives and managers could also be undertaken to seek their views on current and future integrated reporting practices.

Climate change will have a major impact on the practices of mining companies in the future and there is a need for studies to address how mining companies address this environmental issue. Studies like Pellegrino and Lodhia (2012) need to be followed by further work that explores actual climate change accounting practices of mining companies. The disclosure of climate change matters in a range of media is another area worth investigating.

Water Accounting is an emerging area of research in sustainability accounting (Chalmers et al., 2012) and there is need for further studies to extend the work of Kemp et al. (2010) and explore water management and its reporting in the mining industry. For instance, Kemp et al. (2010) and Hazelton (2013) link water disclosure to human rights, suggesting that such information is critical to stakeholders.

Social media is becoming an increasingly important corporate communication tool and it is of interest to research its use for sustainability communication. Studies are required that would expand the work of Lodhia (2004b, 2005, 2006a, 2006b, 2012b) which looked at the use of corporate websites, and explore whether and how mining companies are using social media for communicating social and environmental information. Mining companies do not sell their products directly to consumers and require less need for electronic media for advertising and marketing purposes (Lodhia, 2012b). They are therefore likely to use social media more extensively for their image management because social and environmental performance is often related to their “licence to operate”.

Most sustainability accounting and reporting studies focus on annual performance. However, the electronic means of communication discussed previously enable more timely disclosure and future studies could explore ongoing disclosure. This has the potential to facilitate studies of specific events, such as a major social and environmental incident. Incidents like the OK Tedi disaster involving BHP Billiton took place at a time when information and communication technology usage and potential was not prominent. However, present day incidents have extensive coverage and disclosure, and studies can seek both corporate and stakeholder views of these incidents.

The mining industry has a wide ranging set of stakeholders. There is a need for further studies such as Murguía and Böhlting (2013) to consider how mining companies manage and engage their stakeholders, especially in relation to their sustainability accounting and reporting practices. Such research would facilitate a movement away from a corporate perspective and provide a “voice” to stakeholders, enabling an understanding of their opinions and concerns. Interviews and focus groups could be utilised for such studies.

The auditing aspect of sustainability accounting and reporting in the mining industry is an area that requires greater emphasis in the literature. Auditing can be internally focused with attention given to internal management systems (Kemp et al., 2012) or it could be external through assurance of reporting practices. Studies are required to establish which type of organisations provide sustainability auditing services, what is being audited (management systems or reports) and how effective is such auditing in the absence of an overall sustainability management and reporting model.

The global operations of mining warrant studies of various contexts. Research on sustainability accounting and reporting in the mining industry should not only be restricted to the developed part of the world. There is a need for literature to extend prior work such as Kumah (2006), Newbold (2006), Evangelinos and Oku (2006), and Murguía and Böhlting (2013) that consider the

practices in developing and underdeveloped countries, especially in relation to multinational operations in these parts of the world.

Studies should not merely be restricted to a corporate focus; studies of other institutions would also be useful. Studies of NGOs and their relationships with mining companies (see for example, McDonald and Young, 2012) would add to the understanding of mining-stakeholder relationships. Similarly, the role of institutions such as the International Council on Mining and Metals and global bodies such as the United Nations in overseeing, encouraging and providing guidance on sustainability in mining operations can also be explored within the sustainability accounting and reporting context.

The emphasis in a majority of sustainability accounting and reporting studies, including those focussing on the mining industry, is on environmental issues. Social issues are equally relevant and need to be explored in further depth. Mining companies do have a role to play in regard to social issues such as health and safety, poverty alleviation, local community development, equitable resource sharing and so forth. Studies are therefore needed to explore the management and reporting of these issues by mining companies. This will enable an assessment of social justice matters within the confines of a large, powerful and wealthy industry.

Studies can seek to comprehend whether the numerous voluntary guidelines and initiatives in the mining industry (such as the global mining initiative, mining certification evaluation project and a sustainable development framework for the Australian mining industry) could contribute to the development of mandatory guidelines for management and reporting of sustainability issues (Lodhia, 2012a). Such developments in guidelines in this industry can have lessons for the development of integrated reporting guidelines.

## 6. Conclusions

This paper has highlighted that whilst the *Journal of Cleaner Production* is not specifically focused on sustainability accounting and reporting, its multi-disciplinary emphasis has provided an outlet for such research, especially for studies on the mining industry. It is hoped that this paper will encourage researchers to pursue the numerous possibilities that exist in relation to sustainability accounting and reporting research in the mining industry. Similarly, a publication outlet such as the *Journal of Cleaner Production* is useful for emerging researchers seeking an impact of research beyond their narrow disciplinary focus. In an academic climate where multidisciplinary and trans-disciplinary research is encouraged, the diverse readership of the *Journal of Cleaner Production* ensures that a broader audience comprehends and cites an increasingly important area of research.

This study found that sustainability accounting and reporting practices in the mining industry are evolving slowly. Whilst some companies have been found to be leading sustainability reporting practices, there is a need for improvements in the management of sustainability issues and the subsequent auditing of these aspects. The situation in developing countries needs to be drastically improved as it appears that multinationals do not extend their accountability in relation to operations in these parts of the world. The involvement of NGOs and the government as regulators has been suggested as essential for making mining companies responsible and accountable for their social and environmental impacts.

This paper contributes to the sustainability and reporting literature by analysing the existing literature on the mining industry in a multidisciplinary journal. The study adds a new dimension to the review literature on sustainability accounting and reporting through its focus on the specific mining context instead of a more

general focus. It has established the key findings in the literature, identified specific trends and highlighted gaps in the current literature. There are emerging areas of research that can be explored within the mining industry context and these research opportunities have also been discussed. Future studies on sustainability accounting and reporting in the mining industry can contribute to, and extend the range of, methods and theoretical perspectives that have been used in the existing research discussed here. Future research could also be undertaken in other similar socially and environmentally sensitive industries; especially in relation to a review of the state of the current literature and opportunities for future research. This will enable comparisons with the current paper and providing an understanding of some of the more general issues impacting socially and environmentally sensitive industries.

This paper also makes a contribution to an understanding of existing sustainability accounting and reporting practices in the mining industry. The analysis of current literature suggests that while progress has been made, there is a need for improvement in existing practices. Sustainability management should focus on reducing and minimising the social and environmental impact of mining operations. Sustainability reporting by mining companies should provide detailed and credible information to stakeholders.

## Acknowledgements

The authors would like to thank the editor-in-chief of this journal for his continual encouragement, and constructive comments on an earlier draft of this paper. The first author would also like to thank the editorial team of the mining special issue for an incredible, intellectual two year journey.

## References

- Adams, C.A., 2013. Understanding Integrated Reporting: the Concise Guide to Integrated Thinking and the Future of Corporate Reporting Do Sustainability. UK.
- Azapagic, A., 2004. Developing a framework for sustainable development indicators for the mining and minerals industry. *J. Clean. Prod.* 12, 639–662.
- Bebbington, J., Larrinaga-Gonzalez, C., Moneva-Abadia, J.M., 2008. Corporate social reporting and reputation risk management. *Account. Audit. Account. J.* 21 (3), 337–361.
- Bebbington, J., Higgins, C., Frame, B., 2009. Initiating sustainable development reporting: evidence from New Zealand. *Account. Audit. Account. J.* 22 (4), 588–625.
- Bebbington, J., Unerman, J., O'Dwyer, B. (Eds.), 2014. Sustainability Accounting and Accountability, second ed. Routledge, London.
- Burritt, R.L., Schaltegger, S., 2010. Sustainability accounting and reporting. *Fad or trend?* *Account. Audit. Account. J.* 23 (7), 829–846.
- Chalmers, K., Godfrey, J.M., Lynch, B., 2012. Regulatory theory insights into the past, present and future of general purpose water accounting standard setting. *Account. Audit. Account. J.* 25 (6), 1001–1024.
- Clarkson, M., 1995. A stakeholder framework for analysing and evaluating corporate social performance. *Acad. Manag. Rev.* 20 (1), 92–118.
- Deegan, C., 2002. Introduction: the legitimising effect of social and environmental disclosures – a theoretical foundation. *Account. Audit. Account. J.* 15 (3), 282–311.
- Dey, C., 2007. Social accounting at Traidcraft plc: a struggle for the meaning of fair trade. *Account. Audit. Account. J.* 20 (3), 423–445.
- Di Maggio, P.J., Powell, W.W., 1983. The iron cage revisited: institutional isomorphism and collective rationality in organizational fields. *Am. Sociol.* 48, 147–160.
- Donaldson, T., Preston, L.E., 1995. The stakeholder theory of the corporation: concepts, evidence and implications. *Acad. Manag. Rev.* 20 (1), 65–91.
- Dowling, J., Pfeffer, J., 1975. Organizational legitimacy: social values and organizational behaviour. *Pac. Sociol. Rev.* 18 (1), 122–136.
- Driussi, C., Jansz, J., 2006. Pollution minimisation practices in the Australian mining and minerals processing industries. *J. Clean. Prod.* 14, 673–681.
- Evangelinos, K., Oku, M., 2006. Corporate environmental management and regulation of mining operations in the Cyclades, Greece. *J. Clean. Prod.* 14 (3–4), 262–270.
- Freeman, R.E., 1984. Strategic Management: a Stakeholder Approach. Pitman Publishing, Boston, MA.
- Gray, R., Adams, C.A., Owen, D., 2014. Accountability, Social Responsibility and Sustainability: Accounting for Society and the Environment. Pearson, UK.
- Hahn, R., Kühnen, M., 2013. Determinants of sustainability reporting: a review of results, trends, theory, and opportunities in an expanding field of research. *J. Clean. Prod.* 59 (1), 5–21.
- Hazelton, J., 2013. Accounting as a human right – the case of water information. *Account. Audit. Account. J.* 26 (2), 267–311.
- Hogan, J., Lodhia, S., 2011. Sustainability reporting and reputation risk management: an Australian case study. *Int. J. Account. Inf. Manag.* 19 (3), 267–287.
- International Integrated Reporting Committee (IIRC), 2013. The International <IR> Framework. Available from: <http://www.theiirc.org/consultationdraft2013/> (accessed 03.02.14).
- Islam, M.A., Deegan, C., 2008. Motivations for an organisation within a developing country to report social responsibility information: evidence from Bangladesh. *Account. Audit. Account. J.* 21, 850–874.
- Jenkins, H.M., Yakovleva, N., 2006. Corporate social responsibility in the mining industry: exploring trends in social and environmental disclosure. *J. Clean. Prod.* 14 (3–4), 271–284.
- Kemp, D., Bond, C.J., Franks, D.M., Cote, C., 2010. Mining, water and human rights: making the connection. *J. Clean. Prod.* 18, 1553–1562.
- Kemp, D., Owen, J.R., van de Graaff, S., 2012. Corporate social responsibility, mining and “audit culture”. *J. Clean. Prod.* 24, 1–10.
- Kumah, A., 2006. Sustainability and gold mining in the developing world. *J. Clean. Prod.* 14, 315–323.
- Larrinaga-González, C., 2007. Sustainability reporting: insights from neo-institutional theory. In: Unerman, J., O'Dwyer, B., Bebbington, J. (Eds.), Sustainability Accounting and Accountability. Routledge, London.
- Lindblom, C.K., 1993. The Implications of Organizational Legitimacy for Corporate Social Performance and Disclosure. Paper Presented at the Critical Perspectives on Accounting Conference. New York, US.
- Lodhia, S., 1999. Environmental accounting in Fiji: an extended case study of the Fiji Sugar Corporation. *J. Pac. Stud. Account. Bank. Financ. Spec. Issue* 23 (2), 283–309.
- Lodhia, S., 2003. Accountants' responses towards the environmental agenda in a developing nation: an initial and exploratory study on Fiji. *Crit. Perspect. Account.* 14, 715–737.
- Lodhia, S., 2004a. Environmental accounting for south Pacific island nations: a possible mechanism for encouraging sustainable development by the corporate sector. *Fijian Stud. Spec. Issue Sustain. Dev.* 2 (1), 111–138.
- Lodhia, S., 2004b. Corporate environmental reporting media: a case for the world wide web. *Electron. Green J.* 20 (1). Retrieved from: <http://escholarship.org/uc/item/20d3x61r>.
- Lodhia, S., 2005. Legitimacy motives for world wide web environmental reporting: an exploratory study into present practices in the Australian minerals industry. *J. Account. Financ.* 4, 1–15.
- Lodhia, S., 2006a. Corporate perceptions of web based environmental communication: an exploratory study into companies in the Australian minerals industry. *J. Account. Organ. Change* 2 (1), 74–88.
- Lodhia, S., 2006b. The world wide web and its potential for corporate environmental communication: a study into present practices in the Australian minerals industry. *Int. J. Digit. Account. Res.* 6 (11), 65–94.
- Lodhia, S., 2007. Corporations and the environment: Australian evidence. *Int. J. Environ. Cult. Econ. Soc. Sustain.* 3 (3), 183–193.
- Lodhia, S., 2010. Research methods for analysing web based sustainability communication. *Soc. Environ. Account. J.* 30 (1), 26–36.
- Lodhia, S., 2012a. A need for effective CSR/sustainability regulation. In: Jones, S., Ratnatunga, J. (Eds.), Contemporary Issues in Sustainability Accounting, Assurance and Reporting. Emerald Publishing, London, pp. 139–152.
- Lodhia, S., 2012b. Web based social and environmental communication in the Australian minerals industry: an application of media richness framework. *J. Clean. Prod.* 25, 73–85.
- Lodhia, S., 2013. Sustainability accounting and reporting: an overview, contemporary developments and research possibilities. In: Wells, G. (Ed.), Sustainable Business: Theory and Practice of Business Under Sustainability Principles. Edward Elgar, pp. 73–85.
- Lodhia, S., Jacobs, K., 2013. The practice turn in environmental reporting: a study into current practices in two Australian commonwealth departments. *Account. Audit. Account. J.* 26 (4), 595–615.
- Lodhia, S., Jacobs, K., Park, Y.J., 2012. Driving public sector environmental reporting: the disclosure practices of Australian Commonwealth departments. *Public Manag. Rev.* 14 (5), 631–647.
- MacDonald, K., 2006. Editorial. Section 1: environmental management, legal and policy issues in the mining industry. *J. Clean. Prod.* 14, 227–229.
- McDonald, S., Young, S., 2012. Cross-sector collaboration shaping corporate social responsibility best practice within the mining industry. *J. Clean. Prod.* 37, 54–67.
- Meyer, J.W., Rowan, B., 1977. Institutionalized organizations: formal structure as myth and ceremony. *Am. J. Sociol.* 83, 340–363.
- Milne, M.J., Patten, D.M., 2002. Securing organizational legitimacy: an experimental decision case examining the impact of environmental disclosures. *Account. Audit. Account. J.* 15 (3), 372–405.
- Murguía, D., Böhlting, K., 2013. Sustainability reporting on large-scale mining conflicts: the case of Bajo de la Alumbrera, Argentina. *J. Clean. Prod.* 41, 202–209.
- Newbold, J., 2006. Chile's environmental momentum: ISO 14001 and the large-scale mining industry – case studies from the state and private sector. *J. Clean. Prod.* 14 (3–4), 248–261.
- O'Dwyer, B., 2002. Managerial perceptions of corporate social disclosure: an Irish story. *Account. Audit. Account. J.* 15 (3), 406–436.

- O'Dwyer, B., Unerman, J., Hession, E., 2005. User needs in sustainability accounting: perspectives of stakeholders in Ireland. *Eur. Account. Rev.* 14 (4), 759–787.
- Panchal-Arora, M., Lodhia, S., 2013. The Gulf of Mexico oil spill: exploring the link between sustainability reporting and reputation risk management. In: *Proceedings of the A-Csear Conference*, Hamilton, New Zealand.
- Peck, P., Sinding, K., 2003. Environmental and social disclosure and data richness in the mining Industry. *Bus. Strategy Environ.* 12, 131–146.
- Pellegrino, C., Lodhia, S., 2012. Climate change accounting and the Australian mining industry: exploring the links between corporate disclosure and the generation of legitimacy. *J. Clean. Prod.* 36, 68–82.
- Roberts, R.W., 1992. Determinants of corporate social responsibility disclosure: an application of stakeholder theory. *Account. Organ. Soc.* 17 (6), 595–612.
- Schaltegger, S., Wagner, M., 2006. Managing sustainability performance measurement and reporting in an integrated manner: sustainability accounting as the link between the sustainability balanced scorecard and sustainability reporting. In: Schaltegger, S., Bennett, M., Burritt, R. (Eds.), *Sustainability Accounting and Reporting*. Springer, Dordrecht, The Netherlands, pp. 681–697.
- Schaltegger, S., Bennett, M., Burritt, R. (Eds.), 2006. *Sustainability Accounting and Reporting*. Springer, Dordrecht, The Netherlands.
- Ullmann, A.A., 1985. Data in search of a theory: a critical examination of the relationship's among social performance, social disclosure and economic performance of US Firms. *Acad. Manag. Rev.* 10 (3), 540–557.
- Whitmore, A., 2006. The emperors new clothes: sustainable mining? *J. Clean. Prod.* 14, 309–314.