Management for sustainability and business performance in the mineral industry

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Abstract
This study has examined how management for sustainability may affect the performance of companies in the mining industry of Brazil. Main results of the survey have shown that there is a positive relationship between some of the factors related to sustainable management practices and business performance.

Keywords: Management for sustainability, Business performance, Mineral industry.

Introduction
The economic and technological development brings consequences for society and the environment, creating new demands and constraints for industrial activity. Increasingly, enterprise competitiveness is related to managing geared for sustainability, integrating environmental protection, social welfare and economic growth. A company that is committed to the future and to sustainability is one that has a business model that assesses the consequences and impacts of their actions and includes social and environmental aspects in its financial outlook (Aligleri et al. 2009).

Business management committed to sustainability is an important matter in all economic and business sectors, though some sectors have greater challenges in view of their productive nature. The mining industry, which is the subject of this study, faces some of the toughest challenges of any industry, when it comes to sustainable development. Minerals are essential to everyday life, since they are turned into multiple products that are used by the population and are essential raw materials for a large number of industries. Moreover, the extraction and processing

of minerals are associated with several social environmental impacts that must be managed so that the industry may develop in a sustainable manner (Azapagic 2004).

In Brazil, the mining sector plays an important role both nationally and internationally, with significant relevance for the local economy. According to statistics of the Brazilian Mining Institute (Ibram, 2010a, 2011), in 2010 the value of production of all mineral products, except oil and gas, reached $ 40 billion, representing an increase of 67% compared to the value recorded in 2009. The trade balance of mining showed significant growth in recent years, and compared to the period from 2006 to 2009, the surplus was on average $ 10.5 billion.

Corporate outlined planning regarding their social liability for conducting mining activities stem from the growing need of companies in this sector to justify their existence and show their effective performance by spreading their social and environmental actions (Jenkins and Yakovleva 2006). Because the mining sector is essential for a number of other industries and because it is an activity of extraction, a management geared for sustainability that aims to minimize the social and environmental impacts inherent in this productive activity is a primary factor for the survival and competitiveness of this activity. Thus, due to the economic representativeness of the Brazilian mineral industry and to the challenges inherent in managing for sustainable mining, this study aims to assess the effects of management for sustainability in the performance of companies from the Brazilian mineral sector.

Management for sustainability

The relationship between business development and sustainable development is a relatively new matter, which started in the 80s and has changed forever the relationship between company and environment. When analyzing what ecologists and economists think, with regard to this matter, one is able to understand that conventional economic theories cannot gear the future, because they have never considered the impact of natural capital. Industries have historically benefited from natural capital, destroying it, and the current industrial system is based on old accounting principles (Park 2008).

Barbieri et al. (2010) assert that the participation of businesses on the cause for sustainable development has initially started due to external pressures, in response to the criticisms and objections of the government and organized communities who blamed the companies for the processes of social and environmental degradation that affected the planet. And recently this matter has become a factor of business competitiveness, which can be a source of differentiation or qualification to remain on the market.

The sustainable organizations are those that seek to be economically feasible and competitive in the market, producing in a way that does not harm the environment and contributing to the social development of the region and the country in which they operate (Almeida 2002). Also according to Savitz and Weber (2007 p. 2), the "sustainable business is one that creates profit for its shareholders, while protecting the environment and improving the lives of people with whom it interacts."

Based on the concept of sustainable organization, the challenge is to have economic welfare, social equity and environmental protection from long-term actions. The integration among the economic, social and environmental dimensions results in a new production paradigm, from the perspective of sustainable development, emphasizing the sustainability of products and processes, and enabling a better quality of life to people within their environment (Daroit and Nascimento 2004).

The dimensions of sustainability are inherent in the concept of sustainable business and are represented based on the Triple Bottom Line, which became known in the business world from the publication of the book Cannibals with Forks: The Triple Bottom Line of 21st-Century Business in 1997. The concept of Triple Bottom Line is presented by Elkington (2001) with the metaphor of the three-pronged fork. Each prong refers to the economic, social and environmental dimensions of sustainability in terms of net profit, seeking to answer the question: would capitalism, like a cannibal, become civilized if he used a fork?

The three dimensions of sustainability, commonly referred to as triple bottom line, should be integrated so that natural resources are used in a manner not detrimental to future generations in the environmental sphere, reducing the impacts of industrial processes. In the economic perspective, it is necessary to preserve the company's profitability and not compromise its economic development. And finally, in the social sphere, which includes the issue of social justice, the ultimate goal is the development of a more just world, through relationships with all stakeholders (Elkington 2001).

Management for sustainability based on economic, social and environmental dimensions aims to provide gains for the company, society and the environment. Aligleri (2011 p. 24) defines sustainable management as "a business approach that takes into account the pattern in ecosystem organization in decision-making and management practices, including assessment indicators in economic, environmental and social dimensions."

In the mining industry, the incorporation of sustainability management practices aims to minimize the environmental impacts inherent to this activity. To Hilson and Murck (2000), sustainable development in the mining sector requires a commitment to continuous environmental and socioeconomic improvement in the exploration, operation and closure phases. Besides the legal instruments, there are also market inducing mechanisms which have contributed favorably to large mining companies assuming greater commitment to sustainable development, such as mining companies being listed on stock exchanges, communications and voluntary instruments such as participation in environmental programs and certifications (Enriquez and Drummond 2007, Enriquez 2009).

For Viana (2007), the consolidation of an environmental policy is essential for the adoption of international standards, such as the series of International Organizations for Standardization - ISO 14001, which include guidelines for the environmental management system, assessment and certification of environmental quality and criteria to evaluate the quality and effectiveness of the business or environment relationships. The environmental concern of companies in the mining sector involves not only the preservation of an ecosystem and the ensuring of community safety, but also human welfare and the rights of the local inhabitants, and the quality of life of current and future generations. The principles of sustainable development require economic growth and environmental preservation from the outset of a project, including the assessment of moral and ethical values, and considering the subjective values of the community, rather than just emphasizing the traditional economic value (Amade and Lima 2009).

Considering the peculiarities of the mining sector and the importance of its involvement and commitment to sustainability, there are significant causes in favor of sustainable development in the mining industry. These causes have led mining to achieving its social license to operate, by integrating sustainability in its strategies. For Azapagic (2004), some international initiatives are important in what regard sustainable development in the mining industry, such as the United States Sustainable Minerals Roundtable, the Canadian Minerals and Metals Initiative,

and the European Industrial Minerals Association. Another initiative worth mentioning is the creation of the so-called International Council on Mining and Metals, which consists of a forum based in London, founded in October 2001 to represent leading international mining and metals businesses, with the goal of improving the performance of companies in the sector (ICMM 2010).

To achieve its goal, the ICMM has developed partnerships with several institutions such as Non-Governmental Organizations (NGOs), International Organizations, Universities, among others. Through these partnerships, the ICMM serves on several issues, such as climate change, health and community safety, the impact of mining on biodiversity, the rights of indigenous peoples and also the reflections in the industry and the future consequences of the emergence of new global agents. The proposal is to encourage mining businesses to learn how you can share positive practices (ICMM 2010).

According to the ICMM (2010), in 2003 they developed a model for sustainable development, called Sustainable Development Framework, to ensure that there would be standardization among its members on the adoption and enforcement of policies established by the model. The framework consists of ten principles; public reporting and independent audit, and is among the most advanced voluntary initiatives in this category, with the intent to improve the performance of the mining industry.

Its ten principles have been created based on other guiding global standards, such as the Rio Declaration on Environment and Development 1992, the Global Reporting Initiative, the Organisation for Economic Co-operation and Development (OECD) for Multinational Enterprises, the operating policies of the World Bank, the OECD's Anti-corruption Convention, the International Labour Organisation and the voluntary principles on security and human rights (ICMM 2008).

The assessment of business performance of the mining industry requires some specific indicators, in view of the peculiarities of the mining activity, which are discussed in the following section.

Corporate performance and indicators of sustainability

Performance indicators seek to assess the results achieved by organizations based on the established strategies, to enable the development of new plans and / or proposals for improvements. Indicators are composed of one or more variables that are associated through various forms and express broader meanings about the phenomena to which they refer, enabling the monitoring of the company interests and allowing action planning aimed at performance improvements (Villas Bôas, 2011; Callado, 2010).

There are many proposals of indicators to measure sustainability; however, the initiative of the Dutch agency Global Reporting Initiative (GRI) represents one of the broadest and well-known scopes worldwide. The GRI consists of an international non-governmental organization, founded in 1997, headquartered in the Netherlands, which has as its mission to develop and globally spread sustainability reporting guidelines for companies worldwide (Ethos Institute 2010b).

Sustainability performance indicators proposed by the GRI are divided into the economic, environmental and social categories. Each category includes information on the form of management and a corresponding set of key and additional performance indicators. Key indicators consider essential aspects that are relevant to most organizations, and additional

indicators represent emerging practices or deal with issues that may be relevant to certain organizations (GRI 2006).

The Mining and Metals Sector Supplement consists of an appropriate version of the G3 guidelines of the GRI indicators for the metals and mining sector, including industry-specific comments on the content of the guidelines and additional performance indicators, to ensure that reports on sustainability cover key industry issues effectively. The supplement covers all major sector activities, such as exploration, processing of metals and primary minerals, including metal manufacturing and recycling, the entire life cycle of the project, from development, operational life, to closing and post-closing of operations. In order to do so, some key issues are addressed for the sector, such as ecosystem services / biodiversity, emissions, effluents and waste, work, indigenous rights, community, manual and small-scale mining, resettlement, closure planning, material management (GRI 2010a).

The mining industry has been seeking to adopt practices of management for sustainability that can reduce social and environmental impacts and ensure greater competitiveness for the industry. From this theoretical framework, the central hypothesis of the study is drawn up:

H1: Management of sustainable practices affects the performance of businesses in the mining industry.

Management for sustainability significantly contributes for the development of corporate performance. Sustainable strategic management is geared towards economic, social and environmental results related to innovation, for the organizations and their stakeholders.

Study Method

This study is characterized as descriptive and quantitative, and its objective was to examine the influence of deploying practices of management for sustainability in the performance of companies in the Brazilian mining industry.

Management practices for sustainability were examined based on the ten principles of ICMM (2008) for sustainable development in the mining industry. Corporate performance was assessed based on the performance indicators proposed by the Global Reporting Initiative (2006), grouped into the economic, environmental, and social categories. In addition, the Mining and Metals Sector Supplement indicators were used, which are specific for the mining and metals industry (GRI 2010b). For this study, the indicators that most relate to the sector under study were used.

For data collection, a structured questionnaire was created based on the literature review and on the conceptual model. The questionnaire was divided into four blocks: profile of the respondent; characterization of the business; practices of management for sustainability and; corporate performance.

The questionnaire was sent by e-mail to the companies that were the object of this study and data was collected from October 2011 to January 2012. The target population of the study is constituted by 290 companies linked to the Brazilian Mining Institute. There was a return of 32 questionnaires, representing 11.03% of the population surveyed. Although the rate of return is not considered high, the results found allow the specific analysis of the characteristics and behaviors of the companies studied.

Analysis and discussion of results

Based on data obtained through survey research, the next step is the analysis processing. Regarding the profile of the respondents, it can be noted that the average work period of the

employees in the companies is approximately 14 years. Most respondents have graduate education and occupy senior roles (CEOs, directors, partners and managers).

It should be noted that a significant portion of professionals occupy positions that are directly related to the area of sustainability, which shows that some companies have specific positions for the management of social and environmental issues, thus, this sector is in fact concerned with sustainability. Based on what the respondents answered about their education and position in the company, it can be concluded that the professionals participating in the research have appropriate profiles and are qualified to provide information for this study.

The companies are characterized by their lifetime, location, primary product produced, number of employees, gross operating revenue in 2010. The average lifetime of these companies is approximately 40 years, and the oldest organization is 130 years old, whereas the youngest is 3 years. Most of the companies studied are located in the states of São Paulo (31.3%), Rio Grande do Sul (21.9%) and Minas Gerais (18.8%), and have as main products mineral aggregates (21.9%), limestone (21.9%), coal (15.6%) and iron (12.5%).

The companies studied predominantly have more than 499 employees (34.4%), and this characterizes them as large regarding the number of employees. Most companies (31.3%) had gross operating revenues in 2010 of over R$ 2.4 million up to R$ 16 million (small business). Thus, given the representation of the sector in the Brazilian economic and industrial activity and the environmental impacts inherent to mining, the sample of companies analyzed can be considered adequate for assessing the performance of the sector in relation to the practices of management for sustainability and to corporate performance.

Factorial analysis of independent and dependent variables

Aiming at reducing the number of indicators in each variable by identifying the key components of each factor, the technique of factorial analysis was used. The technique of factorial analysis generates new factors to reduce the number of indicators for each variable. The statistics related to such technique have indicated that it is appropriate to be used in this study. With KMO index greater than 0.6 and sphericity test $p < 0.00$, there is evidence of a relationship among indicators, which provides for the proceeding of analysis. The factors were extracted by means of the principal components method, using the Kaiser criterion for the selection of factors with eigenvalues whose explained variance is greater than 1. It is noteworthy that indicators with high rates of non-response (over 30%) were not included in the initial model of analysis.

Management for sustainability

The management practices for sustainability construct that was developed based on the ten principles of ICMM (2008), at first consisted of 10 variables and 26 indicators.

Results of the factorial analysis converged on six factors that explain 86.27% of data variance. The first factor, called the integration of sustainable development to the process of corporate decision-making, constitutes the most representative data and lists the policies and ethical business practices, risk management strategies and the regarding of sustainable development in decision making.

The second factor, called the sustainable management of the supply chain, deals with aspects of materials and waste management, aiming at sustainability. The third factor, continual improvement in the environmental area, covers aspects related to environment preservation, except for the indicator fair compensation of employees and adequate working conditions, which is a social issue and has been integrated to this factor.

The fourth factor, called continual improvement in health and safety and respect for the local community, encompasses concern for employees and the local community. The factor before the last, called transparency with stakeholders and development of communities, addresses the disclosure of corporate performance to stakeholders and the development of the host community. The last factor, called uphold fundamental human rights, regards the avoidance of using forced, compulsory or child labor.

Due to the high rate of non-responses, the environmental certification indicator was not included in the factorial analysis model. The following indicators - sustainable development as a priority, employee empowerment, commitment to stakeholders, system of continuous interaction with stakeholders and environmental management system - showed a low degree of correlation with the factors extracted after the initial rotation and were not allocated to retained factors.

The following factors - integration of sustainable development to the process of corporate decision-making, sustainable management of supply chain, continual improvement in the environmental area and continual improvement in health and safety and respect for the local community - are the most significant, because they integrate seven of the ten principles for sustainability in the mining industry and seventeen of the indicators proposed in the original model (ICMM, 2008). Accordingly, the technique of factorial analysis showed to be adequate for the theoretical basis of this study, and it allowed us to reduce the number of indicators in each variable.

Corporate Performance - Impacts

The corporate performance construct - impacts, developed based on the indicators of GRI (2006 2010b), originally consisted of 26 variables and 31 indicators. Hourneaux Junior (2010), in their study, has also conducted a factorial analysis of the GRI indicators, including 34 variables, and the result converged on five factors that explained 69.35% of the total variance.

Results of the factorial analysis converged on six factors that explain 80.28% of data variance. The first factor relates to the economic and environmental impacts and covers indicators that regard the following variables - market presence, indirect economic aspects, and emissions, effluents and waste. It includes the two economic indicators that remained in the model and two environmental indicators related to the reduction of the total amounts of overburden, waste rock, tailings and sludge and their associated risks, and to reduced emissions of greenhouse gases, effluents and waste.

The second factor is called social and environmental impacts, and is related to the following variables - products and services, transportation, child / slave labor and stakeholders. It covers two social indicators related to the involvement of stakeholders and non-use of child and/or slave labor, and two environmental indicators regarding the environmental impacts of products and services and the transport of materials and workers.

The third factor is called social impacts relating to labor practices and decent work, and covers the following variables - employment, health and safety at work, and training and education. It basically encompasses aspects related to the health and safety of workers. The fourth factor, social impacts on human rights and society, comprises the following variables - investment and purchasing process practices, non-discrimination and community.

The fifth factor, social impacts related to product liability, includes the following variables - customer health and safety, labeling of products and services and material handling. Finally, the last factor, social impacts related to compliance, addresses the reduction of significant fines and non-monetary sanctions for noncompliance with laws and regulations.

Due to the high rate of non-responses, the following indicators - products and packaging recovery compared to total sales, operations in or near the territories of indigenous peoples, conflicts related to land use with local communities and indigenous peoples, initiatives to promote resettlement and rehabilitation of resettled people, operations with closure plans, and investment in anti-corruption mechanisms - were not included in the factorial analysis model.

The following indicators - direct economic value generated and distributed, policies, practices and proportion of spending on local suppliers, use of materials from recycling, direct and indirect energy consumption, water consumption, rehabilitation of land used in production activities and/or extractive use - showed low degree of correlation with the factors extracted after the initial rotation and were not allocated to the retained factors. These indicators are the most significant, because they include thirteen variables and fifteen indicators of the originally proposed model based on the GRI (2006, 2010b). The factorial analysis was adequate for the conceptual model initially proposed reducing the number of indicators in each variable.

Analysis of the relationship between the independent and dependent variables

Spearman correlation analysis was applied on the factors obtained in the factorial analysis technique, which correspond to the independent and dependent variables of the study. It was possible to observe the existence of six significant associations (0.01** and 0.05*) involving the twelve factors related to practices of management for sustainability and corporate performance, as shown in Figure 1.

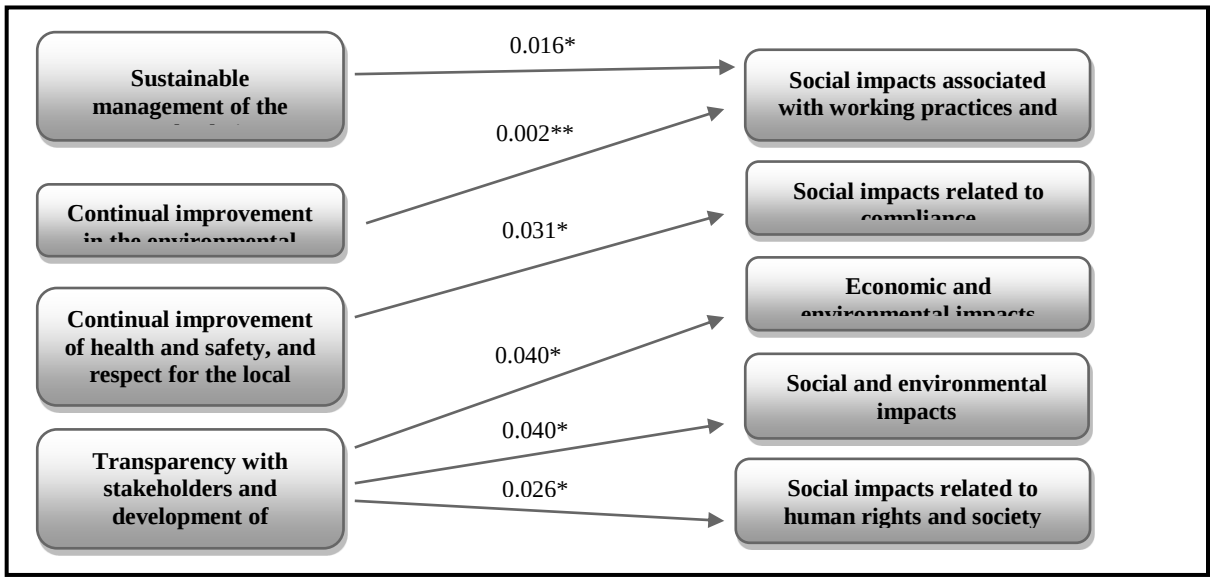

Figure 1 - Correlations between practices of management for sustainability and corporate performance

The correlation tests have revealed that there is a positive association among four of the factors that make up the practices of management for sustainability with five of the factors being related to corporate performance. The correlations with the other factors of the model were not significant. Overall, the result shows that there is a positive relationship among some of the factors related to sustainable management practices and corporate performance.

It is worth noting that four of the factors related to the independent variable analyzed are linked to corporate performance. The factors - integration of sustainable development to the

process of corporate decision-making and uphold of fundamental human rights have no significant relationship with corporate performance. And also, the social impacts related to product liability are not related to any of the management practices for sustainability.

The factor - transparency with stakeholders and community development - had the highest number of correlations with corporate performance, proving to be present in most of the studied companies and to contribute to higher business performance.

The transparency with stakeholders intends to disclose to stakeholders the economic, social and environmental performance and the contribution of the company for sustainable development. Accordingly, Jenkins and Yakovleva (2006) emphasize the importance of disclosure of social and environmental actions in the mining industry, in order to enable improvements in the image of companies towards society, and also because of the appreciation by investors of entrepreneurial attitudes concerned with social, environmental and ethical issues.

The factors have indicators that relate to employees, and because of that, are related to the factor of social impacts regarding labor practices and decent work. Concern for the health and safety of workers is a recurring mark on the management practices of the companies studied, because of its importance in the context of the mining activity. Data agree with analyses made by Moreira (2003) and Azapagic (2004), where they suggest that the environmental impacts related to mining activities entail above average threats to the health and safety of workers, a fact that indicates that companies need to be extremely attentive to that.

The factor of continual improvement in health and safety and respect for the local community is associated with social impacts related to compliance, demonstrating that businesses seek to meet regulatory aspects in order to reduce significant fines and non-monetary sanctions for noncompliance with laws and regulations.

Final considerations

The present study, which aimed to analyze the influence of management for sustainability on the performance of companies in the Brazilian mining sector, showed that the models that resulted from the multivariate technique of factorial analysis were statistically adequate and have largely converged with the originally proposed conceptual model. Correlation analysis has allowed us to conclude that there are positive associations among some of the factors related to the practices of management for sustainability and corporate performance.

It is worth mentioning that the following factors - sustainable management of the supply chain, continual improvement in the environmental area, continual improvement in health and safety, transparency with stakeholders and community development - were associated to business performance. It is noteworthy that the factor transparency with stakeholders and community development had the highest number of correlations with corporate performance, showing to contribute to corporate performance.

The central hypothesis that guided the achievement of the research results, in which the management of sustainable practices affects the performance of companies in the mining sector was corroborated, suggesting that companies who seek superior performance must be aware of the deployment of sustainable practices.

Based on this study, it was possible to show evidence of the behavior of the companies from the Brazilian mining sector, to what regard management for sustainability and its implications for corporate performance, and key elements where identified for improvements on this field.

References

Aligleri, L. M. 2011. *A Adoção de Ferramentas de Gestão para a Sustentabilidade e a sua Relação com os Princípios Ecológicos nas Empresas.* Universidade de São Paulo, São Paulo.

Aligleri, L. et al. 2009. *Gestão Socioambiental:* R*esponsabilidade e Sustentabilidade do Negócio.* Atlas, São Paulo.

Almeida, F. 2002. *O Bom Negócio da Sustentabilidade*. Nova Fronteira, Rio de Janeiro.

Amade, P., H. M. de, Lima. 2009. Desenvolvimento sustentável e garimpo: O caso do garimpo do Engenho Podre em Mariana, Minas Gerais. *Revista Escola de Minas Gerais* **62**(2): 237-242.

Azapagic, A. 2004. Developing a framework for sustainable development indicators for the mining and minerals industry. *Journal of Cleaner Production*, **12**(6): 639-662.

Barbieri, J. C. et al. 2010. Inovação e sustentabilidade: novos modelos e proposições. *Revista de Administração de Empresas*, **50**(2): 146-154.

Callado, A. L. C. 2010. *Modelo de mensuração de sustentabilidade empresarial: uma aplicação em vinícolas localizadas na Serra Gaúcha.* Universidade Federal do Rio Grande do Sul, Porto Alegre.

Daroit, D., L. F. NASCIMENTO. 2004. *Dimensões da inovação sob o paradigma do desenvolvimento sustentável.* Enanpad, Paraná.

Elkington, J. 2001. *Canibais com Garfo e Faca.* Makron Books: São Paulo.

Enríquez, M. A. R. da S. 2009. Mineração e desenvolvimento sustentável: é possível conciliar? *Revista Iberoamericana de Economía Ecológica* **12**: 51-66.

Enriquez, M. A. R. da S., J. Drummond. 2007. Social-environmental certification: sustainable development and competitiveness in the mineral industry of the Brazilian Amazon. *Natural Resources Forum* **31**: 71–86.

Global Reporting Initiative. 2006. *Diretrizes para Relatório de Sustentabilidade.* Available at http://www.globalreporting.org. (accessed data October 12, 2010).

Global Reporting Initiative. 2010a. *Sector Supplements*. Available at http:// www.globalreporting.org/ReportingFramework/SectorSupplements. (accessed data October 28, 2010).

Global Reporting Initiative. 2010b. *Mining and Metals Sector Supplement*. Available at http://www.globalreporting.org. (accessed data October 28, 2010).

Hilson, G., B. Murck. 2000. Sustainable development in the mining industry: clarifying the corporate perspective. *Resources Policy* **26** (4): 227–238.

Hourneaux Junior, F. 2010. *Relações entre as Partes Interessadas (stakeholders) e os Sistemas de Mensuração do Desempenho nas Organizações*. Universidade de São Paulo, São Paulo.

Instituto Brasileiro de Mineração. 2010. *Informações e Análises da Economia Mineral Brasileira.* Available at http://www.ibram.org.br. (accessed data June 10, 2011).

Instituto Brasileiro de Mineração. 2011. *Indústria da Mineração: Informativo do Instituto Brasileiro de Mineração.* Available at http://www.ibram.org.br. (accessed data February 28, 2011).

Instituto Ethos. 2010. *Principais Modelos, Diretrizes para Relatórios de Sustentabilidade da Global Reporting Initiative*. Available at http://www.ethos.org.br. (accessed data November 10, 2010).

International Council on Mining and Metals. 2008. *10 Princípios para o desempenho no campo do desenvolvimento sustentável.* Available at http://www.icmm.com/document/1323. (accessed data December 10, 2010).

International Council on Mining and Metals. 2010. *Sobre o ICMM*. Available at http://www.icmm.com/portuguese>. (accessed data November 20, 2010).

Jenkins, H., N. Yakovleva. 2006. Corporate social responsibility in the mining industry: exploring trends in social and environmental disclosure. *Journal of Cleaner Production* **14**: 271-284.

Lacy, P., T. Cooper, R. Hayward, L. Neuberger, 2010. A new era of sustainability. *Accenture Sustainability Services.*

Moreira, H. F. 2003. *O Desenvolvimento Sustentável no Contexto do Setor Mineral Brasileiro.* Universidade Federal do Rio de Janeiro, Rio de Janeiro.

Park, J. 2008. China, business and sustainability: understanding the strategic convergence. *Management Research News*, **31** (12): 951-958.

Savitz, A. W., K. Weber. 2007. *A Empresa Sustentável*. Elsevier, Rio de Janeiro.

Viana, M. B. 2007. *Licenciamento Ambiental em Minerações de Minas Gerais: Novas Abordagens de Gestão.* Universidade de Brasília, Brasília.

Villas Bôas, H. C. 2011. *A Indústria Extrativa Mineral e a Transição para o Desenvolvimento Sustentável.* Mct Cnpq, Rio de Janeiro.