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**Sustainable development indicators concerning the
natural stone sector**

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Sustainable development indicators concerning the natural stone sector

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RESUMO

A atividade econômica mineral está passando por grandes mudanças a nível global causadas pelas atuais políticas de cunho social e ambiental. As rochas ornamentais, como qualquer outro segmento da mineração, devem enfrentar o mesmo desafio de se adequar e buscar atender aos princípios do Desenvolvimento Sustentável (DS), avaliados através de indicadores de sustentabilidade. Este artigo apresenta um panorama histórico do entendimento dos princípios do DS voltados aos recursos naturais não-renováveis focalizando a atividade mineral e, em especial, o segmento das rochas ornamentais. Sugestões sobre sistemas de indicadores são apresentadas, bem como discute-se a importância da divulgação pública do desempenho medido obtido.

Palavras-chave

Rochas ornamentais, desenvolvimento sustentável, indicadores de sustentabilidade.

ABSTRACT

Mining business is undergoing a major change due to new environmental and social policies worldwide. Natural/Dimension Stone, as a branch of the mining sector, will have to face the same challenge - to follow sustainable development (SD) principles evaluated through sustainability indicators. This article presents a historical survey on SD principles devoted to non renewable natural resources, focusing the mining business, especially the natural/dimension stone branch. Suggestions on indicators systems that might be adopted are highlighted, as well as the importance of reporting SD performance to the public.

Keywords

Natural stone, dimension stone, sustainable development, sustainability indicators.

1 | INTRODUCTION

Since the release of the Brundtland Commission Report (1987) many countries started to seriously discuss their development policies and the consequences of wrong decisions taken in the present for the future generations. The 1992 Earth Summit in Rio de Janeiro shows that the environment component had to be taken into account in order to guarantee conditions for economic development itself. Mining was considered an environment harmful business and was not even mentioned in the Agenda 21, the more important document from the Summit, that shows the main issues and areas of concern in order to face sustainable development threats.

Sustainability concept is connected to the ability of environment systems to react to external pressure and shocks, and their return (or not) to normal or previous functioning (SHIELDS, 2005). Non renewable resources, such as minerals, do not fit to this definition but have an essential role for sustainable development since social needs and quality of life depend a lot on them. The sustainability issue for mineral industries has to be approached as a strategy to develop business reducing dramatically risks and damages to the environment and to communities and, consequently demonstrating its beneficial results to society. Mining professionals and business men have to work hard to change the image of mining as “the necessary evil activity”.

We must remember that in the late eighties and early nineties, mineral extraction and processing industry were severely criticized because of the conservative and sometimes irresponsible way environment was managed in most mines and processing plants. For instance, in the USA, during President Clinton’s

government, the traditional mining federal agency, the Bureau of Mines, was shut down in 1995 and new mining operations suffered enormous restrictions. It became almost impossible to open a new big mine in the US territory.

Those facts caused unusual reactions on traditional mining countries. The Canadian mining industry saw the menace of being reached by its neighbor policy and started, together with federal and regional governments, to rethink the mineral sector under a nationwide multi stakeholder consultation named "The White Horse Mining Initiative" (Mc ALLISTER, 1996). Although the initiative showed poor practical results, business men, government officials and citizens started to realize that a change in the old paradigm had happened and that it was time to stop complaining against environmental laws and NGOs criticism, and time to hold the stake and to start individual voluntary initiatives. After that, the Mining Association of Canada (MAC) launched the "Towards Sustainable Mining Initiative", in 2000, to enhance the industry's reputation by improving its environmental, social and economic performance.

Almost at the same time, the EU also started its own stakeholder consultation for the mineral sector split into three sub-sectors: the metallic, the industrial and the construction minerals, aiming to collect enough data and fulfill a set of 20 sustainability indicators for each one (EU, 2006).

This exercise proved to be useful in an attempt to choose indicators, to motivate most EU countries and their industry associations to work together, but some of the data collection, specially the one related to construction minerals, did not get the minimum participation required to be considered realistic of the EU situation.

In the nineties, even after hosting the 92 World Summit, the Brazilian mining industry was still uncomfortable and reactive against moving to new standards of environmental and social responsibilities. In 1998, CETEM - Centre for Mineral Technology (Brazil) promoted, in association with CANMET, the Mineral Research Institute of Canada, the first symposium on "Mining and Sustainable Development" in the historical Ouro Preto mining town. Professor Roberto Villas Boas one of the most well known mining SD experts, proposed to launch the so called "Ouro Preto Initiative" but had no response from the Brazilian government or mining sector.

Among other developing countries, India has also tried to follow a similar track since it was proposed by the India Federation of Mining Industry to create the "Sustainable Mining Research Network – SMRN" (SHARMA, 2006). Most of the Indian concern was connected to the amount of illegal mining, especially small scale and artisanal, that although harmful to the environment, it is the only means, most of times, that people have to survive in many India regions. No information could be traced to check if this initiative succeeded or not.

The USA also gave steps forward on sustainability indicators, based on a first experience made by the Interagency Working Group on Sustainable Development, using the US Forest Service previous experience (1998) and, finally, the Sustainable Minerals Roundtable - SMR was established in 1999 to provide a special set of indicators for the minerals sector (SHIELDS, 2005).

New tools, other than stake holder approaches and round tables, came to foster environmental management.

The ISO 14000 series introduced worldwide recognized standards that help the individual companies/plants to manage their own

environmental conditions and respective impacts. In this context, Life Cycle Analysis is being considered an important tool to measure the environmental performance allowing comparisons among products by checking every step of production, use and discard/recycle of products and is useful to feed data for several sustainability indicators as well as for green communications and green marketing instruments (BLENGINI *et al.*, 2008).

The larger world mining companies recognized their high level of responsibility on SD principles implementation. The International Council on Mining and Metals, representing those companies, worked on a Sustainable Development Framework (2003) that provided a set of ten guideline principles to address ethical and governance issues related to biodiversity, communities' development, transparency in communications, etc. One very important tool that arose from this initiative was the commitment to demonstrate transparency in reporting their activities, results, social and environmental accountability using the GRI – Global Reporting Initiative report model (www.icmm.com/reporting).

On the other hand, industrial corporations may have to face auditing from banks and financing agencies, since the largest international banks, about seventy by now, are following the guidelines of the Equator Principles, based on the International Finance Corporation - IFC/World Bank proposal, in order to evaluate and guarantee positive environmental and social responses from their investments in projects worldwide. Most banks ask companies to show their performance reflected in the IFC/Equator sustainable indicators auditing for loans from 10 million USD on.

In this new century, social responsibilities came to play an important role as well. For instance, in most developing countries artisanal mining still provides income for thousands of individuals

and families. Despite artisanal mining of gold and gems being widely recognized, small-scale production of gravel, natural stones, sand and clay are usual in many countries.

International social concern pushed the preparation of the new ISO 26000 standard series, to be released in 2010, since they will provide guidelines for improvement and reporting of social responsibility, that it is not intended to be another third party auditing standard such as the 14000 series.

Climate change perspectives have also been of major concern since the Intergovernmental Panel on Climate Change-IPCC first report. While governments and politicians keep discussing, the organized and responsible societies and their NGOs will be working to inform public and ask for urgent national, regional and international solutions.

After this short historical review on SD facts, it is important to show figures of the natural/ornamental stone international extraction/production sector, as well as to report projects and regional initiatives to illustrate and help evaluating what is being done to improve sustainability indicators, and to understand some of the challenges that are being or will be faced soon.

2 | NATURAL/DIMENSION STONE FIGURES

The following Tables, taken from the annual report STONE 2008 – World Market Handbook (MONTANI, 2008) show some interesting information over the Natural/Ornamental Stone sector about trends before USA subprime mortgage crisis, followed by the world economy crisis (2008-09).

First of all, the world production between 2003-07 was growing at high rates: quarries extraction about 30% and final products about 37% (by weight). From the total produced, 41 to 49% correspond to the rock/stone average waste from quarries and processing steps, respectively, meaning almost 57 million m³ of raw material waste. Although there are many alternative applications for the waste rock, logistics and other costs strongly reduces their feasibility.

Table 1. World stone production year 2007.

World Stone production (2007)					
Parameters	000 tons				
	2003	2004	2005	2006	2007
Gross quarrying	153.700	166.500	175.750	190.150	212.000
Quarrying waste (1)	78.750	82.250	89.500	97.500	108.500
Raw production	75.000	81.250	85.250	92.750	103.500
Processing waste (1)	30.750	33.300	34.950	38.000	42.500
Processed production	44.250	47.950	50.300	54.750	61.000

Waste material destined for granules, podwers and other uses are included

Source: Montani, 2008.

The construction sector absorbs around 75% of stone final products, as can be seen in Table 2. All products show high consumption

increase but this is most significant for the “decorative works” such as countertops, tables and bathroom tops.

Table 2. Finished products world market 2007.

World stone industry: net finished production main uses of worked material			
Applications	%		± %
	'95	'07	Av./year
Floors and paving	38,0	34,5	10,1
External wall cladding	12,0	7,5	6,1
Steps	4,0	3,5	9,4
Internal wall cladding	6,0	9,0	22,2
Special works	10,0	19,5	31,3
Subtotal building sector	70,0	75,0	13,5
Civil external uses	10,0	6,0	4,0
Memorial art	15,0	16,5	14,1
Other uses	5,0	2,5	1,8
Other uses subtotal	30,0	25,0	4,5
Total	100,0	100,0	12,0

Source: Montani, 2008.

In Table 3, the world net production share shows that the Asian countries, especially China and India, are leading the raw materials and the finished products ranking, followed by the EU 27. Waste losses show impressive figures reaching 151 million tons or equivalent 700 million in square meters of 2 cm thick tiles.

Those figures are insignificant if compared to the average waste losses in metals extraction processes. For instance, the average loss of most metals extracted from mines up to product

manufacturing was roughly estimated as being around 54% (VILLAS-BÔAS, 2002).

Table 3. World stone quarrying production and finished product yield - 2007.

Zones	1,000 tons	
	Abs. figures	shares
EU/27	25.400	24,5
Others Europe	2.850	2,8
Subtotal	28.250	27,3
North America	3.200	3,1
Latin America*	6.500	6,3
Subtotal	9.700	9,4
China	26.500	25,6
India	13.000	12,6
Others Asia	19.300	18,6
Subtotal	58.800	56,8
Africa	6.500	6,3
Oceania	250	0,2
Subtotal	6.750	6,5
World	103.500	100,0

* Latin America's figure is underestimated since Brazil produced around 8 million ton in 2007 (Anuario Mineral – DNPM, 2007).

Source: Montani, 2008.

Driven by SD principles, the following questions might be answered:

- To what extent the natural/ornamental stone favours sustainability?
- How far is the natural/ornamental stone sector from a fair sustainability level?
- Which indicators should be considered for the follow up of this sector's sustainable performance?

3 | IDEAS AND CLUES TO GET ANSWERS

To answer the first question, we have to remember that sustainability is usually analyzed through three dimensions: economic, environmental and social. Also, it is a context-dependent concept, once it is a function of people's moral and cultural values (SHIELDS, 2005). If we analyze the stone sector considering the three SD dimensions, even without any further indicators list in hand, we realize that the economic aspect is always the major concern that promotes wealth especially in developing countries, as can be seen in the previous Tables.

New players are leading the economic expansion, such as China, India, Brazil and Turkey, but the traditional ones, mainly Italy and Spain, are keeping their positions, also benefiting from the stone globalization process. This is a positive aspect that should help the other countries to raise their performance.

Under the social aspect, once again is important to split the visions. In developing countries, job generation and maintenance are well accepted both by governments (because of income taxation) and by local communities, since jobs bring earnings to the people, as recently reported for a huge natural stone brazilian cluster (CASTRO *et al.*, 2011). Nevertheless, most small mining and quarries in the developing world do not follow the basic rules for workers safety and procedures against usual quarries occupational diseases. Other casualties and damages also happen outside the quarries, as for example road accidents involving natural/dimension stones transportation. These casual problems contribute to a bad perception of the stone sector and undermine the public opinion about the stone business.

In developed countries, where communities are more aware of such problems, stone quarries and processing plants obey, in

general, most safety procedures due to labor laws enforcement and unions pressure. New technologies also contribute to increase safety and labor health conditions which certainly contributes to the decreasing number of accidents and casualties. For instance, University de Vigo and Politecnica de Madrid developed a software tool named Rock-fall risk assessment for quarries - ROFRAQ, that will help quarries to avoid predictable accidents with rockfalls (ALEJANO *et al.*, 2010).

Maybe we can raise other pros and cons, more facts and opinions, but such social indicators, related to social responsibilities, highlight the unsustainable aspects of this business. The environmental dimension is the Achilles' heel for the mining sector. Remembering the figures in Table 1, the raising amount of waste and residues are still a major challenge to be faced by the stone business. There has been many well succeeded projects which provided or addressed solutions, not only for the larger quarries/processing units, but also for the small ones. CETEM's experience in Brazil helped to prove that even very small quarries may be reoriented in the sustainability direction proving that it is technically feasible and cost effective, although it may demand a slow rebuilding process of cultural and educational behavior for operators and stake holders too.

Despite still believing in positive changes resulting from comprehension and search of voluntary agreement, behavioral improvement has to be based on the rational use of the law, as well as in enforcement procedures to encourage small businessmen and their mining technical staff to comply with environmental and workers safety rules. Certainly after an expected first negative positioning, the reaching of some important goals will help people to believe in further changes, and then it is time to start with the voluntary initiatives.

From all previous considerations, it can be assumed that the environmental and the social dimensions deserve special attention because most of the natural/ornamental sector is not organized at the regional and international levels to work together, and face common challenges showing improvements and a new approach towards SD.

The second question is: How far is the sector from a fair sustainability level?

One very conclusive evaluation is presented by Blengini et al. (2008) along with many suggestions about this topic. We have to agree that the majority of the stone industry is still not motivated to show its performance regarding SD principles and indicators. For instance, the absence of stone products and producers in the EU Ecolabel (www.eco-label.com/portuguese) for hard floor coverings may have many reasons. Around 430 products were eco-labeled by the EU in this category, as reported in the above mentioned website, and it must be emphasized that only ceramic products, mainly from Italy and Spain, were listed.

The author suggests that stone producers are more familiar with mandatory regulations to safety and environmental restrictions rather than voluntary market-oriented schemes, such as the green market, and that the ceramic industry motivation comes from the pressure upon those certifications determined by overseas markets (North America and Australia). Our experience proves that the brazilian stone industry works the same way. Comparing the ceramic and the stone industry, we have to take into account that the average size of companies are different since ceramic companies are larger and many of them have a multinational profile. The costs involved in obtaining certifications such as ISOs, EU and others are high, and the specialists say

that the decision has to be taken by the producer because there must be an evaluation on the benefits and profits that one may have since they will probably occur in the long run, and only sometimes in the short term for specific markets.

Another issue to be addressed is that countries' sector associations may have to assume the leadership in order to motivate their affiliates to be stakeholder starters of the process. We have to remember that even large mining companies started adopting SD principles by using their country associations, or creating a forum like ICMM (International Council on Mining and Metals), that implemented an internal process to gradually train and help decision makers and executive business people.

As has been widely reported, the stone sector is still rather far from the other mining sectors present level with respect to SD subjects, but it is necessary a performance evaluation through indicators so to make a meaningful intersectoral comparative analysis. Anyway, the few successful examples and the difficulties for starting voluntary initiatives are evidences of retarding SD actions.

The third question is: Which indicators should be considered for the follow up of this sector's sustainable performance?

The EU Non Energy Extractive Industry SD Indicators 2001 – 03 (EU, 2006) is one source of indicators; they have been collected to show aggregate SD sectoral performance on a regional or national basis. Data collection has been made through regional or national sectoral producers' associations and worked well in sectors with a small number of associations. It is not difficult to organize a regional or national survey and prepare a report. This might be seen as a preliminary work, a warm-up activity, to motivate companies to participate.

In order to start individual initiatives the TSM - Towards Sustainable Mining Methodology set by The Canadian Mining Association seems very comprehensive and shows good results in Canada. In this case, each indicator is evaluated under five levels of performance, ranking from LEVEL 1 (no action promoted) until level 5 (excellence and leadership). Some indicators fit to quarry operation such as the Energy Use and GH Gases management, but the crisis management and the tailings management might be adapted to the sector's reality and situation. Those indicators help companies to measure their individual performance comparing its figures to the average responses from other similar ones.

The GRI/ICMM proposal is more complex, although might be seen as a goal because this type of reporting includes independent auditing and GRI official auditing. When fully approved, the report is publicly disseminated through the GRI and companies websites and can be used to evaluate the SD behavior, thus allowing comparison with other reports prepared by companies ranging from very different industrial sectors to services and NGOs as well.

It has to be mentioned that mining branches e.g metals, construction materials, minerals for fertilizers, etc, and possibly in each country or country region, may need to build their own set of indicators since standard indicators may not capture peculiarities in some fields. A comprehensive review on sustainability indicators and its selection was recently released by Villas-Bôas (2011).

For the stone sector, the first efforts came from The Marble Institute of America and the National Stone Council. Even after the US housing sector has been hit very dramatically since 2008 by the economic crisis, MIA is promoting a very impressive initiative to incorporate SD principles and best practices in the

stone business (MARBLE INSTITUTE OF AMERICA, 2011). The issues that are being addressed are:

- Change of Industry Perception
- Develop and spread best practices
- Create standards for the stone sector
- Create a Certification Program

The main push came from the green building wide spread wave and its certification system – LEED (www.usgbc.org) which evaluates related construction materials impacts among other issues to evaluate how green is the building. The process has already begun, as stated by ECOFORM (consultancy), which will perform facilitation and standard discussions together with NSF (National Sanitary Foundation) and other organizations, such as the Centre for Clean Products of the Tennessee Univ., that will bring technical background and expertise to the initiative (Centre for Clean Products, 2011). Anyway, hopefully this initiative might be the catalyst for a worldwide stone business change towards SD principles and practices adoption, especially for the raw materials producing countries.

Peiter and Villas-Bôas (2008) proposed a simpler method to evaluate sustainability through a heuristic model based on the so called “Sustainability Matrix”. The case study was a natural stone production cluster in Brazil, where many small quarries employ a huge number of local people. Stakeholder’s answers to a specific enquiry were analyzed and balanced to fill the cells of the matrix with scores in order to evaluate specific aspects, while those scores summing indicate levels of the three sustainable dimensions (social, environmental and economic). The matrix works like instant pictures, taken from time to time, and maybe very useful

to evaluate qualitative changes in sustainability since it evaluations are based on individual perceptions obtained by interviews.

The long list of available information on previous practices and initiatives undertaken in mining sector may help the natural stone sector to start a global debate on sustainability targets for the present and future.

4 | CONCLUSION

Natural resources business, and mining in particular, is undergoing a major paradigm change that drives to a more responsible and sustainable production followed by performance results and public reporting. Some very sound initiatives are being tailored to fit to the natural/dimension stone sector helping to improve environmental and social practices towards SD principles, but still are just local practices and deserve further dissemination. A discussion on sustainability indicators selection, adoption and public reporting is urgently needed. Businessmen, government staff, political and community representatives, as main stakeholders groups, are expected to collaborate and work together to speed up this process in order to raise levels of sustainable aspects of natural stone resources production and use.

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