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Sustainability certification scheme for the dimension stone industry in Brazil: a proposal for an initiative based on the northwest region of Espírito Santo State, Brazil

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ABSTRACT

This paper presents an initial assessment of the possibility of structuring a sustainability certification scheme for the dimension stone industry in Brazil. A survey was conducted based on perceptions of key stakeholders with experience in Brazil's dimension stone industry and connected to it through research or institutional affiliations. Twenty-three out of twenty-six stakeholders agreed to be interviewed. Six groups of 40 questions included general and specific topics containing open-ended and multiple-choice questions on three main themes: sustainability, challenges to the sustainability, and deficiencies and omissions of the current regulatory scenario of the dimension stone industry. The findings demonstrated that participants have a positive perception about the feasibility of a sustainability certification scheme for the dimension stone industry in Espírito Santo State. Responses provided by the sample of stakeholders interviewed indicated that such a certification scheme would find support from key stakeholders and also legitimacy. In addition to this broader conclusion, other options were validated, including the agreement in the list of entities that could be part of the group relevant to the dimension stone industry. In this context, participation of public powers is essential, but in indirect participation in the scheme to avoid contamination of the balance of forces. This would support its evolution with promotion and collaboration tools, which would help solve the deficiencies of inadequate performance. More research is needed on the main challenges and impacts of such an initiative for a certification scheme. Recommendations for a preliminary model are given, based on the results of the interviews, and also on economic, social and environmental data about the dimension stone industry in Brazil and on the literature about certification schemes.

Keywords: certification schemes, dimension stone industry, challenges, sustainability certification scheme.

Highlights:

- A sustainability certification scheme for the dimension stones industry.
- Survey based on the perception of key stakeholders with experience in Brazil's dimension stone industry
- Findings demonstrated a positive participants' perception about the feasibility of a sustainability certification scheme for the dimension stone industry in Espírito Santo State.

1. Introduction

Increased societal and consumer concerns about social and environmental impacts have contributed to the development of certification schemes (Schiavi and Solomon, 2007; Mori Jr et al., 2016). The certification process seeks to encourage

competitiveness through processes with a lower environmental impact by the introduction of technical and legal standards (Vidigal, 2015).

As well as environmental considerations, current certification schemes address social aspects and companies' social responsibility. This new concept is absorbed in the so-called Sustainability Certification Scheme (SCS), defined as all types of certification schemes and standards that address governance and social and/or environmental issues, as a result of a public claim, that attest the compliance with these issues and provide guidelines within which different organizations can cooperate to deliver more sustainable practices (Mori Jr et al., 2016).

The mining industry recognizes that a compliance-based approach is not enough to meet current accountability demands from communities and governments worldwide. Mining can play an important role in delivering positive economic benefits to local communities affected by mining activities by reducing social inequalities and poverty (WEF, 2016). In this context, mining companies noticed that the use of certification schemes can improve the reputation of the sector as a whole and also to differentiate responsible mining operations from poor performers (Schiavi, 2003).

Moran and Kunz (2014) argued that certification schemes have the capacity to improve practices in the mining sector, but these improvements should be evaluated by considering progress towards minerals and energy sustainability. Large companies are already seeking solutions to the impacts generated by the activity, but small and medium enterprises (SMEs) do not consider social and environmental issues especially if there is poor management of their activities, or if there is poorly designed project implementation. Certification schemes should be introduced as a viable option for SMEs, as well as for large mining companies (Rose et al., 2006).

This should apply in the dimension stone (DS) industry, an important industry in economic terms (Furcas and Balletto, 2013; Cosi, 2015) consisting of medium and small enterprises. Data on the DS industry show that:

- global production of DS grew from 1.8 million tons/yr in the 1920s to 116 million tons in 2011 (Chiodi, 2013) and to 136.5 million tons in 2014 (DNPM, 2015);
- Brazil is currently the fourth largest producer of DS in the world, being responsible for 7.4% of total production, behind only China (31.1%), India (14.2%) and Turkey (9.3%) (DNPM, 2015);
- Brazil is the seventh largest exporter in the world, with a production

chain composed of approximately 10,000 companies (DNPM, 2015);

- directly and indirectly, the production chain generates employment for 130,000 people, mainly in the southeast and northeast, which are the producing regions of the country (DNPM, 2014);
- the growth of the industry has been boosted by increased national and international demands and exports now account for 50% of the total production, mainly to the United States (60%), China, Italy and Canada;
- in Brazil, the recoverable reserves of DS (30% of the measured reserves) are approximately six billion cubic meters (DNPM, 2015);
- Espírito Santo State leads the national production of DS and has great investment in research on geology as well as on extraction and processing technologies (Sardou Filho et al., 2015).

Despite its economic importance, the DS industry in Espírito Santo State still has several problems, which include the use of poor methods for extraction and processing, leading to predatory mining with large-scale waste generation, problems with health and safety of workers, and changes to the landscape.

All these issues are a challenge for the sustainability of the DS industry, which has been conducted without a formal chain of custody resulting in substantial losses of government revenue, employment opportunities and foreign exchange earnings (Brasil, 2013). These issues can deeply affect the sustainability performance of the DS industry in Espírito Santo State.

The originality of the research in this paper is to consider the strategies required before an implementation of a SCS to achieve sustainable development of the DS industry in Espírito Santo State, because this industry does not yet have an organization that could effectively contribute to this process. Action on the results of this research by those directly involved with the sector will be necessary to develop an effective work's strategy with all affected communities to achieve a successful implementation of a SCS.

In order to be effective, any proposal to design and implement a SCS for the DS industry in the northwest region of Espírito Santo State in Brazil should consider the following aspects:

- the Brazilian Mining Code and current environmental legislation provide the legal basis for the use of mineral resources in this region, but it is not enough for the DS industry;

- the geological characteristics of the region mean there is great potential for the exploitation of the resource, but there is no awareness in the sector about the finite nature of reserves and consequently their rational use;
- the trends observed in the export policy of the largest buyers indicate a need for greater control of the products, suggesting a certification process;
- the exploitation of DS is a traditional activity with great social, economic and even cultural significance, with several municipalities economically dependent on income from it. However, the population has no perception of the impacts generated by the sector or how to obtain the best results from it, which include the quality of life for themselves and for future generations.

Therefore, this article aims to explore the feasibility of an effective SCS for the DS industry in Espírito Santo State based on a series of surveys carried out with many stakeholders, including entrepreneurs and representatives of governments and society. The following topics were used to frame the research questions to be discussed with participants during interviews:

- (1) the performance of the DS industry concerning investment in initiatives to improve its environmental and social performance;
- (2) the main sustainability challenges faced by the DS industry to improve its performance;
- (3) the main regulatory challenges faced by the DS industry to improve its performance;
- (4) the involvement of public or private bodies that should participate in feasibility studies of a SCS for the DS industry in Espírito Santo State, considering the need to ensure the legitimacy of the process;
- (5) the involvement of participants' bodies in a SCS for the DS industry in Espírito Santo State;
- (6) the feasibility and most important structural characteristics of an effective SCS for the DS industry in Espírito Santo State and in Brazil.

To present and discuss the research project, this article is arranged as follows. Section 1 has introduced the subject. Section 2 presents the theoretical background on certification schemes including those in mining. Section 3 describes the DS industry in Brazil and in Espírito Santo State highlighting what has been done for its sustainability.

Section 4 describes the methodology used in the research. Section 5 presents the results obtained and discussion of them. Section 6 presents the conclusions for a proposal of a SCS for the DS industry in Brazil, derived from a case study conducted in Espírito Santo State (Macedo, 2016).

This research adopted the concept of chain of custody established by WEF (2016), which is a complex chain which involves several stages, from extraction to suppliers, including customers, employees, the media and the community where the business is situated, to achieve synergy in the results.

2. Theoretical background

2.1. Certification schemes

The essence of certification is the institution, verification and inspection of standard compliance about a certain subject (Blackmore and Holzman, 2013). Certification systems aim to raise the level of demands on the private sector, improving their performance in certain aspects, such as health and safety at work, environmental protection, and quality, among others.

Certification systems can achieve this goal through different ways, which justifies their classification into at least two models:

1. performance outcomes, which require field verification of the actual conditions of compliance against certification standards, as in the Forest Stewardship Council (FSC); and
2. an environmental management standard (EMS), which focuses on the establishment of processes and distribution of responsibilities, as in International Organization for Standardization (ISO) 14001 (Cashore, 2002; Carvalho, 2014).

According to Bernstein (2010), an important subject in a certification scheme is the balance of forces based on its governance, involving ideas of shared perception, legitimacy, suitability, responsibility and distributive justice. The composition of these aspects, conventionally called “non-state market-driven governance”, will give the authority for the scheme and for more effective rules to be followed (Cashore, 2002).

A certification scheme must be practical by offering realistic standards widely recognized, must have management of practical, implementable and effective tools in the field, and must consider transparency (WEF, 2016). It must also have defined minimum

requirements of compliance and establish consequences and sanctions for non-compliance, with efforts to foster and improve the level of commitment of participants, especially new starters and those with financial or technical constraints. In this context, lack of sanctions, limited enforcement, lack of specificity of standards and objectives, and failure to attract the poorer performers within a sector can become weaknesses of the process (Schiavi and Solomon, 2007).

There are many variations in the structure and operation of schemes, but the literature shows that they have the same basic components, which are setting the standards, governance, assessment, and assurance (Mori Jr et al. 2016).

The fast growth of certification schemes allied with differences among them has led to questions about their effectiveness and their contribution to economic, social and environmental outcomes.

According to some authors, some key components that must be considered to influence the effectiveness of a SCS are these (Schiavi and Solomon, 2007; Mori Jr et al. 2015):

- sustainability awareness;
- social, environmental and economic impacts;
- stakeholder participation;
- accountability and transparency including disclosure, publication and public involvement.

All these key components were confirmed by the current research project.

2.2. Certification schemes in mining: studies and their findings

Evaluation of the mining sector demonstrates the experiences of companies that certify their operations by the system ISO 14001 and by many other initiatives.

In the 1990s so-called responsible mining was largely viewed as a matter of legal compliance with national mining and environmental laws and regulations, mining concession agreements, labor laws, and collective bargaining agreements, among others (WEF, 2016).

A growing number of voluntary regulatory initiatives relevant to the social and environmental impact of the mining sector have emerged since the mid-1990s (Schiavi, 2003, Schiavi and Salomon, 2007, WEF, 2016). These initiatives have increased substantially since 2000 and have led to significant changes in the mineral industry,

mainly related to its reputation and credibility issues (Schiavi, 2003). These have a variety of names and forms, including reporting mechanisms, guidance documents, management systems, industry codes of conduct and third-party certification schemes (Schiavi, 2003; Schiavi and Solomon, 2007).

In the late 1990s the Global Mining Initiative (GMI) was launched, an effort of independent multi-stakeholders to identify a path towards more responsible behaviour and better reputation. This led to the creation of the International Council on Mining and Metals (ICMM) (WEF, 2016), that implemented toolkits that defined the Sustainable Development System and the Ten Principles, which were the basis for the Mining Certification Evaluation Project (MCEP) (Solomon et al., 2003; Rose et al., 2006).

The MCEP aimed to foster discussions about certification, generating information relevant to future projects based on the experience of other sectors and recognizing as sensitive issues the credibility and effectiveness of the system. The MCEP found good possibilities of applying a third-party scheme to the mineral sector, and of acceptance of the initiative by a significant number of stakeholders (Carvalho, 2014).

Before and after the GMI, mining companies participated in and helped many specific initiatives on issues like transparency, biodiversity, human rights, and cyanide management for gold, among others (WEF, 2016).

Also, in the late 1990s and early 2000s, jewelry companies joined with civil society organizations to promote the idea of responsible sourcing and certification for minerals in jewelry, mainly diamonds and gold (WEF, 2016).

The Kimberley Process (KP) was a multi-sector collection of solutions to challenges in the diamond supply chain, which had historically involved armed conflicts, the reason why they were called “blood diamonds” (WEF, 2016). Although the KP includes environmental aspects among its rules, its main purpose concerns the social issues (Smillie, 2010a). The KP is seen as a successful example of certification because it united the most important companies of the sector and has been achieving its intended significant results (Haufler, 2010). Nevertheless, it has some weaknesses such as the need for national practices to meet internationally agreed minimum standards; weak or non-existent internal controls; no visible monitoring; no credible sanctions for serious non-compliance; failure to include the cutting and polishing industry in the

chain of custody; no public transparency; and no financial or human capacity for independent research and investigation (Smillie, 2010b).

The Mineral and Mining Sustainable Development Project (MMSD) investigated the feasibility of a certification scheme (IIED, 2002; Buxton, 2012). This pointed out the difficulties of establishing a certification scheme due to the heterogeneity of companies in the mining sector and a lack of vertical integration of the production chain (IIED, 2002). According to the MMSD there is a global perception by stakeholders that international standards omitted the establishment of social and environmental standards, which has generated a significant proliferation of certification schemes to address this problem (Carvalho, 2014).

The Extractive Industry Transparency Initiative (EITI) was also launched in 2002 and focused on publicizing reports submitted by mining companies to the government so that civil society could analyze and criticize them (Carvalho, 2014). The limitation of EITI is that it only focuses on taxes or royalties paid to governments, ignoring the broader economic and social benefits at the community level (WEF, 2016).

In 2005, the Responsible Jewelry Council (RJC) was created focusing on supply chain assurance, based on good practice standards and recognition of operations to show and improve transparency (Smillie, 2010a; WEF, 2016). The RJC system has two main limitations: the chain of custody arrangement has not been developed; and it is made up of the largest mining, trading and retail firms in the business with cost and logistics that are undoubtedly beyond the means of most small companies (Smillie, 2010a).

Blackmore and Holzman (2013) quote the International Cyanide Management Code (ICMC) as an example of a certification scheme for management of gold mining. The ICMC is a specific issue, in which certification requires health and safety guarantees for workers and neighboring communities (Carvalho, 2014).

The Initiative for Responsible Mining Assurance (IRMA) was founded in 2006 by stakeholders to improve social and environmental practices in mining activity. IRMA is an assurance program for responsible mining that embraces a multi-stakeholder approach and is seeking to develop and improve new systems (WEF, 2016).

Between 2006 and 2008, a multi-stakeholder process in Latin America developed a collective vision and principles for responsible artisanal and small-scale mining (ASM). This was revised in April 2014 by open forums involving a broad range of stakeholders including the whole supply chain and government. The Fairmined Standard was developed within ASM, with a rigorous, detailed and compulsory code of

practice for companies in gold, diamond and platinum supply chains. As for other schemes it does not include a chain of custody and requires high costs and complicated logistics to be widely implemented (Smillie, 2010a).

In 2008, findings on the growing number of voluntary responsible initiatives, focusing on mining sustainability, identified the potential to prioritize or consolidate them (WEF, 2016).

It is worth highlighting that there are some practices in the mining industry in which an approach based on conformity to standards may not be enough, such as environmental auditing; analysis of life cycle (used to promote “green building”); clean production (a company’s production processes); environmental labeling or green seal; and social responsibility (linked to the ISO rules) (Peiter et al., 2014). It is necessary to distinguish companies that adopt good practices improving their performance, reputation in the mining sector and credibility in their communities (Macedo et al., 2017).

2.3. Examples of certification schemes for the DS industry

Two certification schemes for DS applied outside Brazil are the Nature Stone Council (NSC) in USA and the Brand Stone.pt in Portugal. Both promote the quality of products through business restructuring related to the technological capacity of producers (Banco Espírito Santo, 2014).

In Brazil law 9279/96, article 176, established the obligation to register these geographic data of a mining site:

- *provenance indication*: the geographical name of a country, city, region or locality of its territory, which is a center for the extraction, production or manufacture of a particular product or service;
- *controlled denomination of origin*: the geographical name of a country, region, city or locality of its territory, which designates a product or service whose qualities or characteristics are due exclusively or essentially to the geographical environment, including natural and human factors (Brasil, 1996).

These registrations provide a quality control that allied to other environmental practices can be used not only by micro enterprise, but also by small, medium and large companies, especially the processing ones using cutting (Peiter et al., 2014 in Macedo et al., 2017). Some examples are the provenance indication of the marbles from the

municipality of Cachoeiro de Itapemirim, Espírito Santo State, and the controlled denomination of origin for the Carijó stones (Wood and Grey) from Santo Antonio de Pádua region, Rio de Janeiro State (Peiter et al., 2014 in Macedo et al., 2017).

3. The dimension stones industry

3.1. Relevant characteristics of the DS industry in Brazil and Espírito Santo State

The relevant characteristics of the DS industry are presented in table 1.

Table 1 – Relevant characteristics of the DS industry

Relevant characteristics of the DS industry
<ul style="list-style-type: none"> • it is a distinctive mining sub-sector, mainly composed of SMEs, which has its own features and rules, and shows wide variation in the size of operations, in the level of industrialization and in the application of new technologies (Brasil, 2013; Cosi, 2015); • it is an old industry, whose persistence has been related to aesthetic considerations and to the quality of the natural materials (Cunha et al., 2003); • a lot of companies often have an “one man” company structure, which operates with low technical knowledge of use of modern exploration and low evaluation techniques for the definition of resources/reserves (Brasil, 2013; Cosi, 2015); • there is a common perception of relatively easy investment and fast return in comparison with other mining projects, often without consideration that this is a market driven sector, in which regularly increasing demand for DS products leads to an increase in competition due to the entry of new unskilled players (Cosi, 2015); • DS are not commonly considered as strategic minerals (Cosi, 2015) or commodities (Cunha et al., 2003); • some companies that are focused on the international market invest in technology for the extraction and processing of materials, aiming at the product improvement and cost reduction (Regadas, 2006; Maior, 2013); • the increasingly widespread use of diamond multi-wire looms in the processing of plates, from 100 in 2012 to 200 in 2014 (Brasil, 2013; DNPM, 2015), has generated higher productivity, less waste and a strong logistics advantage (DNPM, 2015).

3.2. Espírito Santo State: case study

The map of Espírito Santo State’s distribution of mining concessions (Fig. 1) shows two main areas:

1. the southern region, mainly in the municipality of Cachoeiro de Itapemirim (Brazil’s biggest producer of carbonate rocks, especially marbles) where there is a high concentration of processing companies;

and

- the northwest region (Brazil's biggest producer of silicate rocks, mainly granitoid rocks) where the quarrying industry is strong (Ministry of Education, 2007).

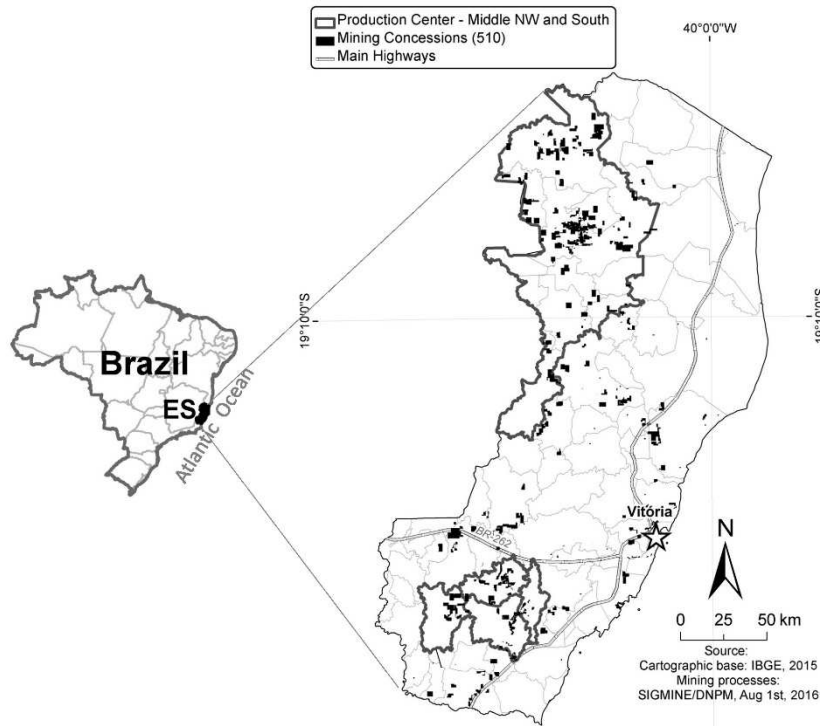


Figure 1 – Map of Brazil with the location of Espírito Santo State (ES), and an enlargement showing the position of the DS production areas of the south and northwest regions of the state, where there is a concentration of sites of mining concessions (Source: MME, 2017)

The good performance of the DS industry of Espírito Santo State derives mainly from:

- great geological potential;
- the presence of Italian immigrants whose knowledge of products and processes contributed to a spontaneous agglomeration of companies of DS mining;
- the proximity to Brazil's southeast region, the largest national consumer market; and
- reasonable support of infrastructure (road, rail and port) for the implementation of mining projects (Spínola 2003; Sardou et al. 2015).

Problems that involve the DS industry range from the lack of planning in the

whole extraction process, the lack of detailed geological studies, use of new technologies, and problems of health and safety of workers to the closure of mine. There is a need for improvements at all stages of the activity and these are closely linked to the proposal to implement a sustainable certification process.

3.2.1. Social and environmental impacts

DS mining projects in Espírito Santo State often require small areas (Iema, 2013), but there are synergistic or cumulative impacts generated by the concentration of projects in the same region (Iema, 2013; Franks et al., 2009). The extracting areas are clearly visible to neighboring communities because of the number of quarries. These communities are directly affected by visual impact, air pollution and noise (Ashmole and Motloun, 2008; Iema, 2013), as well as by the silting of waterways, the lack of environmental recovery of the extraction areas, and mining closures (Brasil, 2013).

There are also impacts related to production, such as the transformation of blocks into polished boards, which may lead to incorrect disposal of abrasive mud derived from the cutting of stones (Regadas, 2006; Maior, 2013). Other critical impacts are the high volume of waste and its inadequate disposal which represent significant losses of volume of rock involved in the process (70% in the dismantling and 25% in the processing) (Castro et al., 2012), the lack of supervision in the industry, and the significant number of traffic accidents caused by inadequate transportation of blocks (MPES, 2014).

The DS industry needs to adapt its business models to cope with the large amounts of waste generated by the low efficiency of operations. Good solutions include the disposal in landfills, but this is costly (Brasil, 2013; Furcas and Balletto, 2013), and the manufacture of aggregates, but this is not economically advantageous when compared to market prices of the products of DS (Furcas and Balletto, 2013). Reuse of waste in the construction of affordable houses in Brazilian government programs is also constrained by economic considerations, such as viable distances from the raw material to the markets. Further studies of reuse are required to identify by-products from DS waste which could be economically profitable for the DS industry and sustainable (Furcas and Balletto, 2013).

3.2.2. Legal aspects of DS mining in Espírito Santo State

DS mining is covered by federal and state jurisdiction rules. Permission for mining processes is a federal matter as in the Brazilian Federal Constitution (Brasil,

1988). The Ministry of Mines and Energy (MME) is the authority for granting permission, and the National Department of Mineral Production (DNPM) is responsible for the regulatory and supervisory aspects. It is worth highlighting that law 13575/2017 created the Nacional Mining Agency (ANM) which will replace the DNPM. The issue of environmental licensing has been discussed in innumerable bills in the Brazilian Congress.

The process of granting access to the mineral deposits in Espírito Santo State is carried out jointly by DNPM and the Institute of Environment of Espírito Santo State (Iema). It is impossible to begin the extraction without environmental licensing and mining authorization. There is also a third factor in the legal scenario, the public prosecutors at federal and state levels, whose mission is to protect society and the environment, and enforce the current legislation.

3.2.3. What has already been done for sustainability of the DS industry in Brazil and Espírito Santo State

In Brazil, multiple stakeholders have taken several measures for sustainability of the DS industry. MME has acted to improve it with the project called Planning and Sustainable Development of DS Mining in the Northwest of Espírito Santo State, which provides an overview of positive and negative impacts of the DS industry (Brasil, 2013). This project resulted in the publication “Basis for the Organization and Sustainable Development of Mining of DS in the Northwest of Espírito Santo” (Brasil, 2013), an essential tool to guide future effective actions. It included a wide survey with relevant stakeholders of the DS industry of Espírito Santo State and the results were consolidated, suggesting solutions for problematic issues. Another result of the project was the beginning of a closer dialogue with the Federal Public Prosecutors and the Espírito Santo State Prosecutors (MPES) who, after several repressive measures, published a guide to good practice called “Sustainability of the DS Sector: towards environmental certification” (MPES, 2014).

In 2015, a partnership between MME and the United Nations Development Programme (UNDP) resulted in a dialogue between multi-stakeholders on the role of the extraction industry in implementing the Sustainable Development Goals (SDG). This partnership also collected reflections on challenges and opportunities, and ideas on how to make the extraction industry a driving force for the achievement of the sustainable development at local, regional, national and global levels (for full results

see: www.extractivedialogue.com) (Macedo, 2016).

In 2014, Espírito Santo State approved a series of decrees that set out rules for the DS industry (DNPM, 2015) to monitor and control mining practices and safety criteria related to the transportation of blocks, but accidents persist (Brasil, 2013; MPES, 2014).

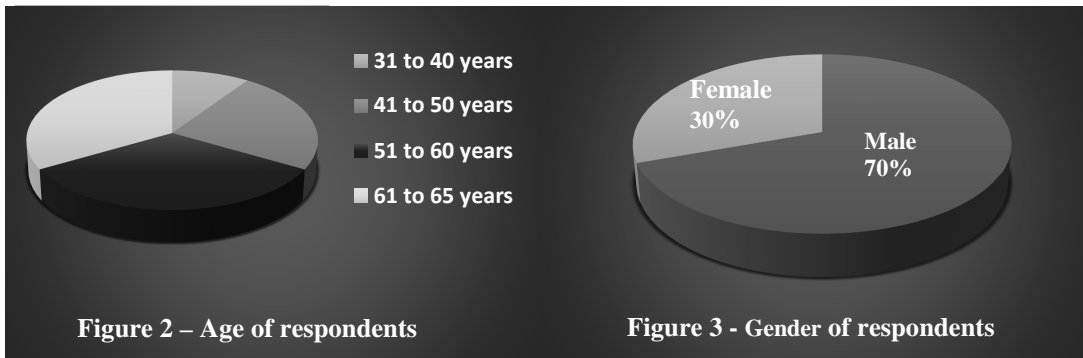
It worth highlighting that in some cases, the DS industry's investment in waste management, training and sustainability in mining operations produced significant returns. The value added to plates by making them end-use parts, for example, improved the competitiveness and helped in the expansion into new markets in the face of international competition (DNPM, 2015). The consistency of these initiatives seems encouraging but there are several challenges that may be obstacles, especially the lack of involvement of stakeholders (Castro et al., 2012) and the lack of resources and people (Borsoi, 2007; Olivieri and Araujo, 2013).

Despite the great contribution of DS mining to the state and national economies, Espírito Santo State does not yet have an organization that could effectively contribute to the economic issue and social and environmental issues becoming a national (or even global) example of sustainable mining. Thus, our survey was conducted aiming to propose a certification scheme for the sustainability of the DS industry in this state.

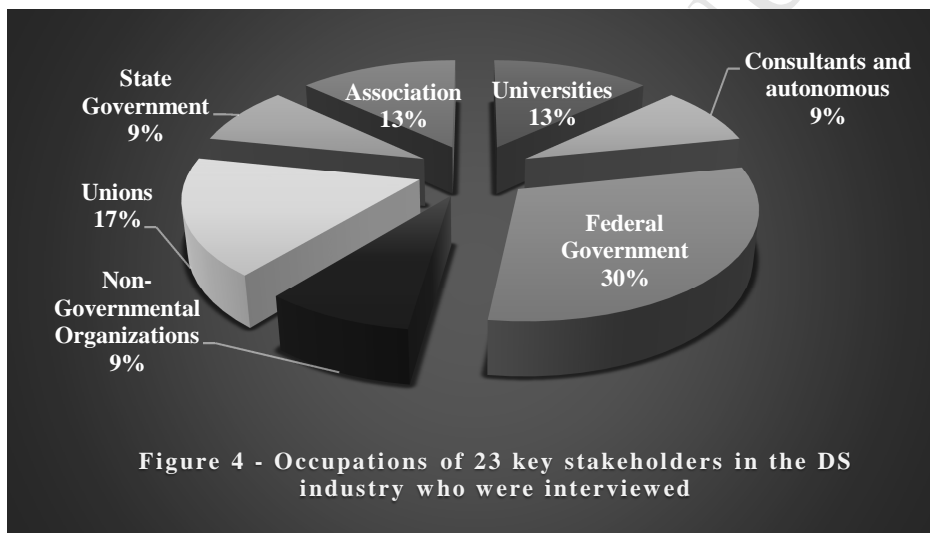
4. Methodology

A survey was conducted to assess the relevance of an initiative of a SCS to show a way for the DS industry to become accountable and sustainable. The basic principle of the survey was that the whole certification process must be transparent and participatory and must make a difference to the industry, taking into account the theoretical and practical aspects of other certification schemes applied to the mining industry (Macedo, 2016). It also has to be relevant to the target audience.

Key stakeholders with experience in Brazil's DS industry were invited to participate. They were necessarily connected to this mining sector. There were few young people (Fig. 2) and most were male (Fig. 3), showing that men occupy many senior positions (Macedo, 2016).



Preliminary contact was made with 26 of these, and 23 agreed to be interviewed (a response rate of 88%). The participants were grouped according to their occupation, and federal government (30%) and unions (17%) composed almost a half of them (Fig. 4). A questionnaire was prepared to determine their perception on an initiative for a SCS in Espírito Santo State, and its relevance to the DS industry in Brazil. The link to the questionnaire was sent by email to the 23 interviewees.



Six groups of 40 questions included general and specific topics containing open-ended and multiple-choice questions on three main themes: sustainability, challenges to the sustainability, and deficiencies and omissions of the current regulatory scenario of the DS industry. Participants' perceptions are shown in the Results and discussion.

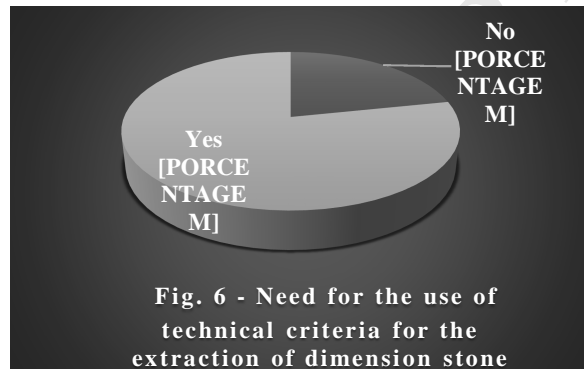
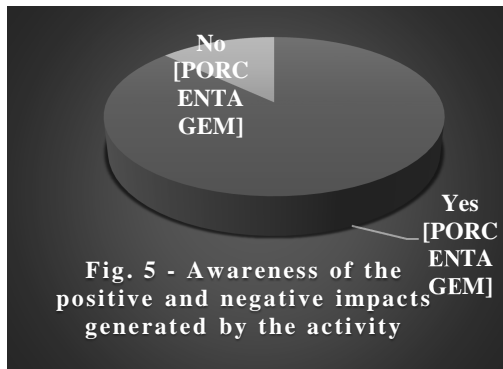
The small sample size means that the analyses in this report must be carefully interpreted and cannot be generalised in a broader context based on this paper alone.

5. Results and discussion

5.1. Sustainability of the DS industry in Brazil

5.1.1. Group of questions 1: the performance of the DS industry related to investment in initiatives to improve its environmental and social performance

Regarding the performance of the DS industry, there was awareness of the positive and negative impacts generated by the activity (Fig. 5), and of the need for the use of technical criteria for exploitation (Fig. 6).



The majority recognition of the need for the use of technical criteria for exploration in DS mining demonstrated a concern about the way mining companies are operating. Investment in geological surveys is needed to guide a systematic approach to the exploitation of reserves. Such an approach would increase the productivity rates of quarries and minimise sterile generation (Sardou Filho et al., 2015).

Participants stated that it is important to address social and economic aspects to improve the sustainability performance of the DS industry. To do so, it is important to design and implement programs to incorporate local labor (Fig. 7) and initiatives for local development (Fig. 8), by using the acquisition of products or services from local suppliers (Fig. 9) and criteria related to the company's social responsibility to choose suppliers (Fig. 10). Also needed are investment in social (Fig. 11) and cultural projects (Fig. 12), and the development of policies for medium and long-term strategic planning for mining activity (Fig. 13).

The question about investment in environmental projects allowed respondents to reflect on whether they are being made and if so what types of investment was being considered. The responses were overwhelmingly positive (83%), including reforestation (25%) and legal reserve areas (20%). Many of the participants considered other mandatory projects within the licensing process, such as environmental compensation, preservation of sources, land reclamation, and construction of landfills for disposal of

waste (Fig. 14). Regarding legal reserve areas, these are required by law, and cannot be considered as an investment.

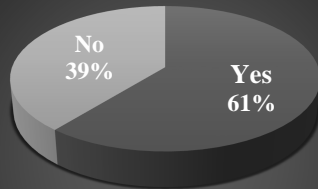


Fig. 7 - Programs for the incorporation of local labor

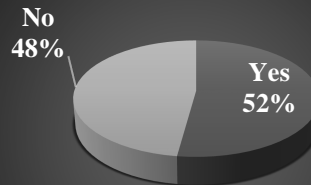


Fig. 8 - Initiatives for local development



Fig. 9 - Social responsibility for the choice of suppliers



Fig. 10 - Use of criteria related to corporate social responsibility for choosing suppliers

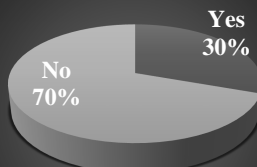


Fig. 11 - Investment in social projects



Fig. 12 - Investment in cultural projects



Fig. 13 - Medium and long-term strategic planning for mining

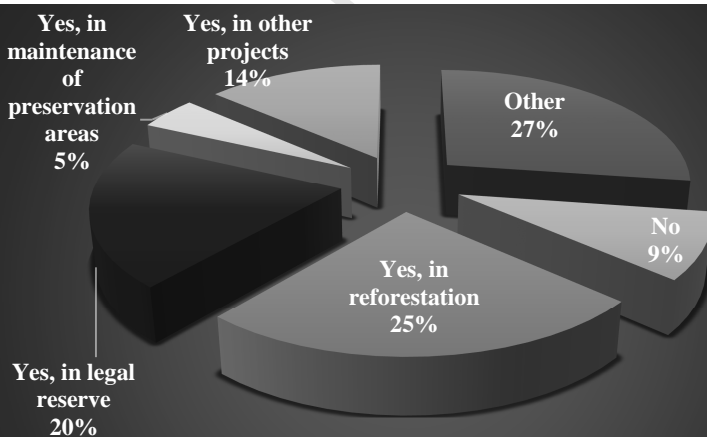
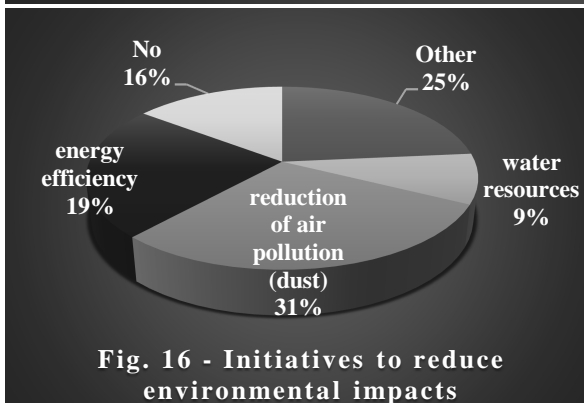
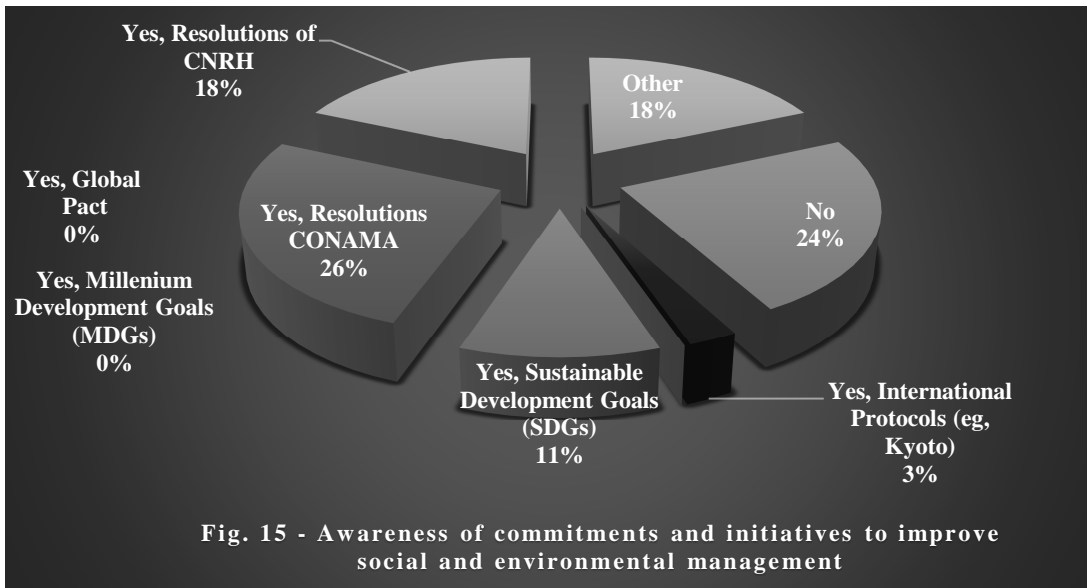


Fig. 14 - Investment in environmental projects

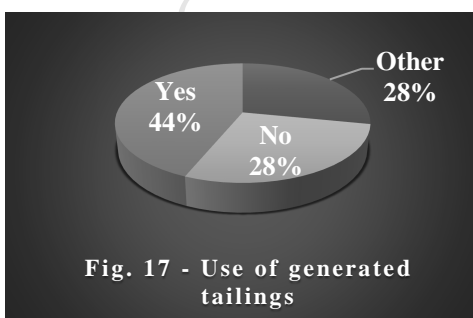
There is a perception that sustainable exploitation is done by companies, but this is not enough. If the activity created jobs, its negative environmental impact could be minimized, and profitability of these companies could be improved, to the benefit of local companies.

The Project "Basis for the Organization and Sustainable Development of Mining in the Northwest of Espírito Santo", developed by the MME, showed that a successful project depends on several factors, among which are geological evaluation and appropriate methods and equipment. The use of technical criteria for the extraction, such as the detailed knowledge of the mineral deposits and the form of their exploitation, are crucial for the planning of mining by choosing and directing the method relevant to the local geology and morphology, production scale and operations planning (Brasil, 2013). About 80% of the interviewees argued that companies used such criteria, but this contradicts the results of the MME's project where it was pointed out that only 50% of mining companies plan and monitor operations, and then only for environmental issues (Brasil, 2013).

Regarding knowledge and awareness of national and international commitments and initiatives, the results showed that there are more awareness of national commitments and initiatives (Fig. 15). The results also showed that there are more initiatives to minimize environmental impact (Fig. 16), than social initiatives. They also showed that the industry seemed to be unaware of those commitments or initiatives. There was knowledge only of resolutions of Brazilian National Councils (the Brazilian National Environmental Council (CONAMA) and the Brazilian National Council of Water Resources (CNRH) and of those which interfered directly with the activity, showing that there was no familiarity with other international initiatives and protocols for sustainability undertaken by Brazil to improve social and environmental management.



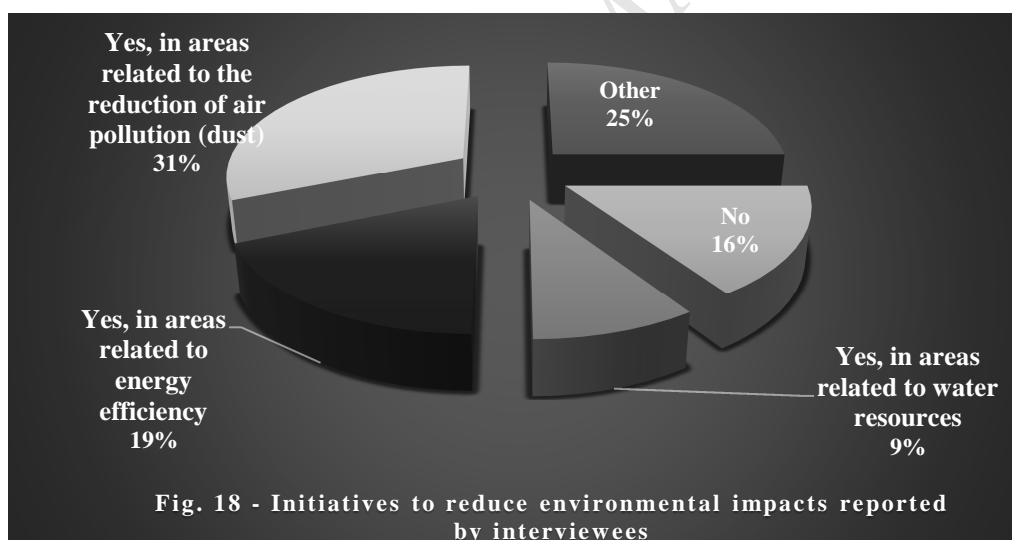
Results related to use of waste generated by DS activity indicated that it is done precariously by some companies. According to some participants, companies could do more. The use of mills for manufacturing of cement and brick blocks were mentioned in the responses marked “other”. Participants also considered reuse practices to minimize environmental impacts and improve profitability (Fig. 17).



The high generation of tailings is one of the major problems in terms of environmental impacts for the exploitation of DS. The average rate of exploitation in

quarries is 20% to 30% (Castro et al., 2012, Brazil, 2013). Cattabriga (2010) in Castro et al. (2012) estimated that more than 5 million tons of thick residues are produced annually in quarries and that about 300,000 tons of residues are processed in Brazil. The results of the project of MME showed that some quarries have an average rate of exploitation of about 20%, with some cases of only 7% for commercial use (Brasil, 2013). The volume of residue generated is still one of the greatest challenges for the DS industry, and despite the initiatives, most of the commitments still remain to be done globally.

Concerning initiatives for reducing environmental impacts, answers indicated that they exist (84%), less on the improvement of energy efficiency than on those related to the reduction of air pollution, noise and water resources. Among initiatives were mentioned the development of better ways of extraction and use of tailings to reduce impacts. As in the question about investment in environmental projects, there were the same comments about adoption of measures only to fulfill the requirements of the licensing process (Fig. 18).



Investment in projects or initiatives to reduce environmental impacts listed by the participants are still preliminary and they point more to environmental control required by the licensing agency than to voluntary initiatives.

There is a concern with technical, economic and environmental issues, but not with social issues. There is an awareness of national initiatives for improving the environment, but there is no awareness of international commitments to improve social and environmental management. Despite the results that pointed to the existence of

programs to incorporate local labor, the results also showed that there is not investment in social and cultural projects and that there is only a little concern about initiatives for local development in municipalities or regions. This is demonstrated by the lack of policies for choosing products and services from local suppliers, and by a failure in the use of criteria to choose suppliers with respect to corporate social responsibility.

5.2. Challenges to the sustainability of the DS industry and deficiencies and omissions of current regulatory processes regarding these challenges

5.2.1. Group of questions 2: the main sustainability challenges faced by the DS industry to improve its performance

There were 27 proposed challenges that were classified in four categories, mainly according to their management.

(1) *Licensing process (public management)*. The whole licensing process was considered a problem for the DS industry. Difficulties included obtaining a license from responsible bodies (74%), its maintenance (35%) and its renewal (52%), the lack of supervision to ensure the effectiveness of the standards, which make the process slower than it should be (61%), and the conditions in the license (52%). Results showed that other difficulties were legal uncertainty generated by the lack of clarity of the regulations (48%), the lack of integration between regulations and information about the territory (30.5%), and environmental fines (26%). Concerning regulatory issues, these indicated that mining legislation partially meets the issues (43.5%) and that the Operating Guide is inefficient (39%). 13% of participants thought that mining legislation does not address the issues. It is worth mentioning that the Operating Guide is a document authorizing mining in an experimental phase, adopted by DNPM to reduce time to mining concessions, which may take more than five years. It does not have legal authority and instead of being an exception, it became the rule.

(2) *Governance and capacity building (public and private management)*. The major challenge identified was the construction of an agenda for the implementation of projects based on common interests involving multi-stakeholders (74%). Other challenges were the restricted capacity of municipalities to manage the use of resources and to solve the problems generated by the activity, and the capacity building for the

extraction of the resource. Challenges of less priority were to increase the participation of local communities in decision making to improve the performance of companies, to decrease the dependence of the municipality and local communities on the extraction industry, to improve the access of the industry to financing, and to increase the participation of state and federal public prosecutors along with local communities where there is DS mining activity.

(3) *Social and environmental responsibility (private management)*. The high priority identified in 56.5% of responses was the need to change the standards of mining operations. These mean to consider the appropriate standards related to human rights, conditions of labor, environmental impact, and business ethics in the chain of custody. Also important were rational access to the mineral resource, the construction of a confidence base among the various stakeholders, investment in geological research, and the correct use of waste by the integration of the chain of custody.

(4) *Technology (public and private management)*. The results showed that 61% of participants considered as high priority the use of cleaner production technologies by the DS industry.

Results showed that the whole licensing process is a major challenge for the sustainability of the DS industry. They also showed that there are legal uncertainties related to mining and environmental legislations and there is a lack of integration and supervision in the establishment of effective standards to follow.

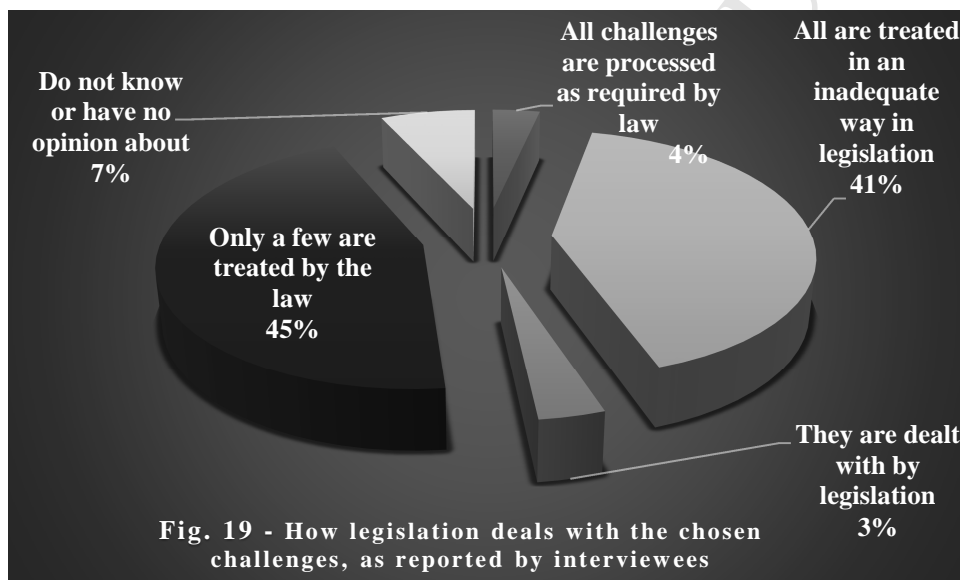
Despite the results, all challenges concerning municipalities must be considered as high priorities. Their low capacity to solve the problems of the DS activity and to decrease the dependence of the municipality and local society on the extraction industry is a huge problem. This involves the need to construct an agenda based on confidence and common interests, with early involvement of multi-stakeholders from the beginning of mining projects, which was the major challenge in governance and capacity building.

Other challenges regarding to social and environmental responsibility identified as high priorities were the need to change the standards of mining operations regarding rational access to the mineral resource, capacity building for DS mining and for environmental issues, and reclamation of mining areas.

All identified challenges must be considered in an attempt to increase the participation of the local community in companies' decision making about their performance. Appropriate standards to apply to DS mining operations should be introduced, including to the use of cleaner technologies, human rights, labor standards, environmental impact and business ethics in the chain of custody.

5.2.2. Group of questions 3: participants' perceptions about the main regulatory challenges faced by the DS industry

Regarding regulatory challenges, the results indicated that 41% thought that challenges are treated in an inadequate way by the legislation and 45% thought that the law treats only a few of them. Only 4% thought that challenges are processed as required by law and 3% that they are dealt with by legislation (Fig. 19).

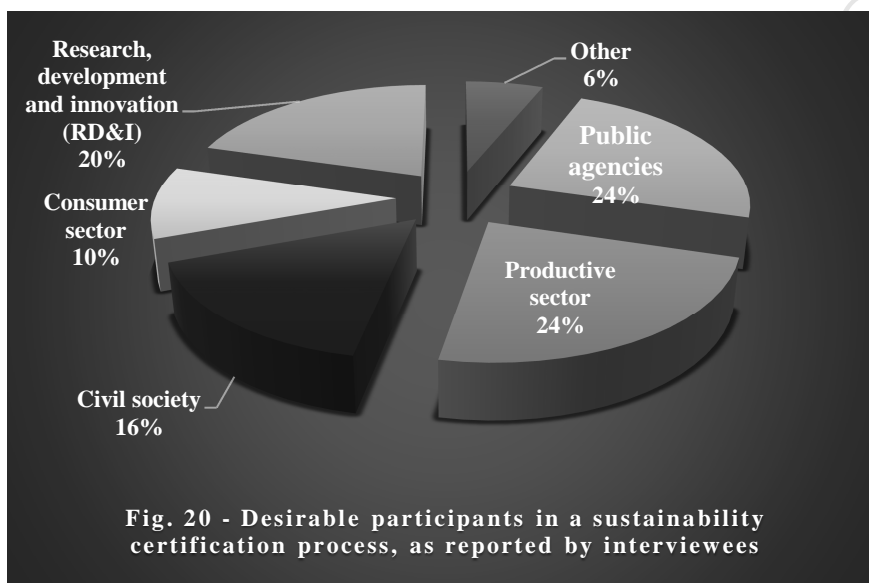


According to the participants' perception almost all challenges are handled improperly by legislation and few participants considered that they are processed as required by law. This shows the interviewees' dissatisfaction with current legislation, both mineral and environmental, covering the sector. The legal uncertainty, for those miners who want to invest, is often generated by the lack of detailed information in the legislation and by the absence of integration between regulations and information about the territory.

5.3. The feasibility of a SCS for the DS industry in Espírito Santo State and the participation of entities/bodies/agencies in this process

5.3.1. Group of questions 4 participants' perceptions about which public or private bodies should participate in a SCS, considering the need to ensure the legitimacy of a measure for the sustainable development of the DS industry

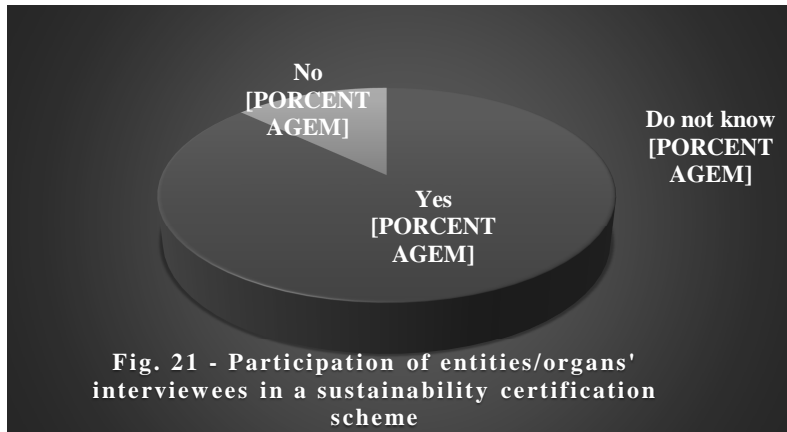
The results indicated a consensus about the need to involve governments, the production sector and the sector of research, development and innovation in a SCS for the DS industry in Espírito Santo State, in order to include interested parties in the process and to ensure legitimacy of this measure. Over 70% of interviewees suggested the involvement of civil society and under half mentioned the consumer sector (Fig. 20).



The success of an initiative such as a SCS depends heavily on its legitimacy by involving as many stakeholders as possible of the DS industry. It is important to know which stakeholders are interested in participating in the initiative. The results verified a congruence of the perceptions, with a balanced distribution of the main actors to be involved in the process. The vast majority of participants want to join a SCS and there was a consensus on the need to involve governments, the production sector, the sector of research, development and innovation, civil society and the consumer sector.

5.3.2. Group of questions 5: participants' perceptions about the involvement of their public or private bodies in a SCS for DS industry in Espírito Santo State

These questions asked whether the organization represented by interviewees should participate in an SCS and the vast majority of participants (87%) answered affirmatively (Fig. 21).



There was almost unanimity regarding the participation and involvement of the interviewees' entities/organs in the process of structuring a SCS for the DS industry. It is important to notice that the participants are aware of the importance of the participation of their entities/organs in an initiative as SCS.

5.3.3. Group of questions 6: participants' perception about whether a SCS can complement current regulations by proposing higher standards for the DS industry in Espírito Santo State and Brazil

The results established a priority ranking based on the interviewees' answers. The main suggested propositions which should be part of a proposal for a SCS for the DS industry are presented in Table 2.

Table 2 - Main propositions for a proposal for a SCS in the DS industry in Espírito Santo State, as supported by interviewees

<u>Proposition</u>	<u>%</u>
<u>Best social and environmental practices in DS mining</u>	<u>82.6</u>
<u>Use of more sustainable technologies; Use planning and post-land use; Concern about the social, economic and environmental development of the local and surrounding communities; Durable solutions for the sustainability of DS industry</u>	<u>73.9</u>
<u>Questions about health and safety at work</u>	<u>72.9</u>
<u>Corporate accountability; Effective plans of mine closure</u>	<u>69.5</u>
<u>Communication plan of business to society about mining activities; Biodiversity conservation</u>	<u>65.2</u>

<u>Strategic planning of DS mining</u>	<u>60.9</u>
<u>Transparency regarding the activities of companies; Participatory process</u>	<u>60.8</u>
<u>Territorial marketing of DS industry involving tourism, among others</u>	<u>47.8</u>

The survey shows that the DS industry has to consider best social and environmental practices, but not only those related to economy, because it is a long-term business that has a profound effect on its host societies.

In addition, the DS industry should also consider as priorities the use of more sustainable technologies, the planning of land use and post-use, and concern for the social, economic and environmental development of the local and surrounding communities. The importance is emphasized of the planning of land use and post-use of the areas where mining activity is installed, as well as effective plans of mine closure, in bringing lasting solutions to the sustainability of DS mining.

Questions on health and safety for workers will help the DS industry to achieve its best social and environmental practices. Therefore, it is essential to show transparency in the social, economic and environmental development of the local and surrounding communities and in the development of a plan of communication between the mining business and the local society.

Companies must incorporate sustainability in their mining activities and recognize that sustainability is not only a marketing strategy to enhance the appearance of their operations and products. They must understand how sustainability issues affect the mining activity and how they can contribute to their profits by avoiding losses.

All the results were consolidated in Table 3 aiming to show participants' perceptions on the more important structural characteristics of a SCS that the DS industry in Espírito Santo State and Brazil would have to address to become effective.

6. Conclusions

The results obtained by this research allowed the conclusion that there is a favorable view of stakeholders on the feasibility of an initiative for a SCS for the DS industry in Espírito Santo State. The responses provided by the sample of interviewed key stakeholders showed that the structuring of a SCS would find support from these stakeholders, and, consequently, would achieve legitimacy in its implementation.

In addition to this broader conclusion, which was the main scope of the research, it was possible to validate other options, among which are the agreement in the list of entities that compose the group of interest for the DS industry. The government (in all its spheres) plays an essential role in a successful initiative of a SCS with indirect participation by supporting its evolution with tools to promote and collaborate to solve the deficiencies of inadequate performance in this industry. It is extremely important that there is early involvement of all stakeholders to turn the DS industry into a sustainable mining activity in Espírito Santo State, and in other regions of Brazil.

Despite some disagreement with data published by the Brazilian federal government, it was possible to identify challenges and opportunities from the participant's perception to complement the current regulation by proposing higher standards for the DS industry in Espírito Santo State and Brazil that can be worked into the development of the proposed certification.

The results also showed that there must be deeper investigation of all aspects before the implementation of a SCS, but there are encouraging signs to continue with this work, because a significant number of stakeholders in the survey reported favorably on the national value of a SCS for the DS industry.

Finally, if all these issues are part of strategic planning, the proposal of a SCS for the DS industry would result in benefits for everyone involved in this industry and would reduce operational, social and environmental costs, as well as minimizing all impacts, and allow it to become an effective sustainable industry.

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Appendix A

Table 3. Guidelines: important structural characteristics that a SCS for the DS industry in Espírito Santo State and Brazil would have to address to be effective

Guidelines	Main structural characteristics	Issues	Relevant comments
<i>Objectives</i>	<ul style="list-style-type: none"> • to foster cooperation and to guide the implementation of more sustainable practices and deliver positive outcomes; • to provide accountability on sustainability and the way that organizations and governments are dealing with their social and environmental impacts. 		
<i>Adherence</i>	<ul style="list-style-type: none"> • voluntary • must bring an advantage over other competitors • at the same time be attractive and feasible for those who wish to be certified (Danielson and Leyton, 2001). 		
<i>Governance</i>		Stakeholder involvement in development of the scheme	<p>Early involvement of multi-stakeholders can avoid distrust, poor intercultural communication and discrepancies in power and capacity between companies and communities (WEF, 2016):</p> <ul style="list-style-type: none"> • governments: indirect participation in the scheme to avoid contamination of the balance of forces, but supporting its evolution with promotion and collaboration tools, which will help solve the deficiencies of inadequate performance (Bartley, 2007); • industry representatives; • sector of research, development and innovation; • civil society; • consumer sector; and • bodies/agencies; <p>Work with local government to improve awareness, understanding, practical knowledge and action to provide a suitable environment for the sector (WEF 2016);</p> <p>Decision making: the authority is dynamic and needs to be promoted by constant and constructive interaction between engaged stakeholders during the development phase and the revision process by public consultation, workshops, etc;</p> <p>Decisions to be taken in the process because it is a challenge to achieve a consensus when a multi-stakeholder approach is adopted.</p>

	Requirements of a scheme for continuous improvement and a review process	<p>Clearly defined and rigorous content, including design, objectives, standards and measurable targets (Schiavi and Solomon, 2007);</p> <p>Indicators linking development and mining, such as social performance measures that can be linked to a mine site, to improve accountability (WEF 2016);</p> <p>Standards</p> <ul style="list-style-type: none"> • balanced number of standards that are not too flexible; • simplified criteria for the establishment of standards for greater effectiveness in their implementation and compliance (Mori Jr, 2015); • comparable generic trade standards can be taken from other initiatives, such as: a) paying a price to producers that covers the costs of sustainable production; b) paying an additional sum that producers can invest in development; c) signing contracts that allow for long-term planning and sustainable production practices (Smillie, 2010a); • standards must be equalized so that they do not overlap on some issues while other issues are not addressed (WEF, 2016); • it is important that the scheme provides detailed information about the existence of periodic revisions of the standards; <p>Costs</p> <ul style="list-style-type: none"> • balanced cost of compliance to get a high number of participants; • certification assessments and audits can be relatively more burdensome for SME, and can create barriers that discourage participation in a certification initiative, which potentially create segregation or discrimination in the industry (Solomon et al., 2006); <p>Assessment of effectiveness</p> <ul style="list-style-type: none"> • not just to measure achievements and guide future improvements, but also to provide accountability to stakeholders and to encourage participation (Mori Jr et al., 2015); • the willingness to demonstrate a commitment of going beyond compliance through the adoption of credible voluntary initiatives that may lead to a preferential or differential treatment by government regulators (Schiavi, 2003).
	Assurance	<p>Selection and accreditation of certifiers and combined audits with annual reports of financial information about the scheme by a third-party certification for the credible independent verification of performance where an external group develops rules and compliance methods for an industry or firm (Solomon et al., 2006).</p>
	Certificates	<p>Feasibility of certifying the chain of custody (Solomon et al., 2003): the environmental impacts of the mining industry could be significantly reduced by improvements in planning and innovation in the whole chain of custody by using new technology in areas such as monitoring, seeking to advance transparency</p>

			or taking account of the implications of new techniques, waste management, water use and energy consumption, renewable energy and increased energy efficiency in the mining process (WEF 2016).
		Dispute resolution:	Appeals process, sanctions for non-compliance and for improper certification: regulatory consistency across operating regions and sectors is necessary to normalize responsible mineral development, and to increase the sector-wide uptake of practices (WEF 2016);
		Legal issues	Establishment and maintainance of procedures to identify legal requirements applicable to all aspects of mining activities, products or services.
		Public disclosure	Improved site-based information from companies and the creation of a responsible mining data bank are among the strategies to enhance information sharing (WEF 2016).
<i>Comprehensiveness and interoperability</i>	<ul style="list-style-type: none"> • cross-communication and links with other certification schemes to identify common goals and strategies to facilitate relationships with stakeholders and supply chain partners (WEF, 2016); • compatibility with national and international complementary private initiatives, and more work must be done in areas such as limitations on particular technologies or practices, and the level of prescription in some criteria, particularly in the context of global standards (WEF, 2016); • investigation to study the feasibility of globally applicable standards, as opposed to regional or local standards (WEF, 2016). 		