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Review article

Governance in mining: Management, ethics, sustainability and efficiency

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ABSTRACT

The concept of governance in the specialized literature is shown to be multidimensional and polysemic. Its development and meaning are marked by the fields in which it is implemented. Notions of governance range from generic approaches with ethical nuances, originating in public management, to more limited and pragmatic approaches, clearly situated in the effective and efficient management of corporate decision-making systems. This paper shows that the concept of governance is applied in a field of activity with a high socio-environmental and economic impact, namely mining. For this purpose, a mixed method study of a database of 186 specialized bibliographical references was undertaken, combining content analysis and conceptual network analysis. The results revealed four models of governance, differing from each other but also with interesting overlaps in theory and application, showing parallels with the specific meanings of governance theories of a more general scope. Mining assumes governance as key to the environment and, as a consequence, to the business. It increasingly sees the environment as complex, difficult and risky, and therefore mining companies tend to consider specific environmental features (natural, social, economic and political) in the internal and external management of their operations. The negative external effects of the extractive industry have forced it to rethink corporate governance beyond internal corporate management, focused until recently (perhaps even today) on economic efficiency.

1. Introduction and objectives

Industrial mining is characterised by its large-scale environmental and socio-economic impact. The desire to mitigate these impacts has given rise to theoretical and political debate around the exploitation of natural resources for economic development and the effects of the mining industry on its socio-environmental context. In recent decades the concept of governance has emerged in these debates as a mode of organising and managing the sector. This is the first reason that justifies the present study. The application of this concept has gone beyond that of being a mere tool for efficient corporate management in the neoliberal sense, since it now encompasses local communities as fundamental and necessary stakeholders. Little attention has been paid, however, to the way that theorisation of governance is developing in the sector (or at least in academic debate on its articulation in modes or levels and on the constitutive principles of governance). The expansion of the concept in the mining industry shows the need to systematise the debate in order to understand the uses of governance. At the same time, its general basis is a theory of governance whose versatility has enabled the extension of its uses and forms to different levels of institutional hierarchy and fields of activity. This is the second reason that justifies this study, calling for an in-depth exploration of what the specialized literature can show us about the application of the various meanings and approaches of the concept of governance to the field of mining.

Thus in this article we explore the application of the concept of governance in the scientific literature of the mining industry through Scopus-indexed works that are directly linked to the topic. To this end, first we examine definitions of the concept, analysing its components and dimensions and its evolution through different modes and uses. An initial general survey suggests that "governance" carries an ethical connotation of goodness ("good governance"), encompassing principles of participation, transparency and accountability in public management. Also notable is the reference to the "know-how" of investing states (i.e. those that "invest in" governance), contrasted to states that are "learners" in governance. At the same time, the ethical dimension is losing ground to a more neutralised concept of governance in which the principle of efficacy extends the economic dimension to other, previously unforeseen areas (e.g. ecological and social efficacy).

A more detailed analysis of the specialised literature shows that these principles and dimensions of governance are being applied to fields other than public management, spreading to business development and management, and particularly in mining projects, with the direct

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application of the above-mentioned ethical (good-governance) and participatory (governance-with-social-participation) connotations. What becomes clear is that the most recent socio-political and regulatory models increasingly identify governance with managing decision-making, although it is not clear how these models affect the design and management of mining projects. Clarifying this issue is the second question that we aim to address here.

2. Background and theoretical framework

Governance has become a fashionable concept since the 1970s and 80 s (Bevir, 2010; Kooiman, 2003; Levi-Faur, 2012). A growing theoretical corpus has developed around it, leaving a number of unaddressed issues in its wake (Mayntz, 2005; E. Sørensen and Torfing, 2018), such as an excess of rhetoric and an indiscriminate and imprecise use of the concept (Colebatch, 2014). Below we outline its theoretical history.

2.1. Defining governance: a prism seen from different angles

In the first works of the founding authors (Jessop, 1998; Kooiman, 2003; Mayntz, 2005; Stoker, 1998) governance was synonymous with government (Graña, 2005). Thus governance was initially seen as the structure of rule or decision-making style adopted in the new relationships between government and society (Aguilar, 2010). International bodies such as the World Bank, IMF and UN (Mayntz, 2005; Peters, 2014) popularised good governance in the 1990s, giving it a prescriptive bias towards horizontal forms of organisation and coordination in decision-making, desirable for governments, the private sector and civil society (Aguilar, 2010; Kooiman et al., 2008; Rhodes, 1996). This was received with scepticism and criticised as a neoliberal assault on some sovereign states (Buitrago, 2011; Bustos et al., 2019; Glückler, 2019; Graña, 2005; Herrera, 2004; Stojanovic and Gee, 2020), since aid to these countries was conditionally tied to their adoption of "good governance". This regulatory concept was subsequently replaced by a theory whose central notion was shared authority as an effective administration tool (Bevir, 2012). Definitions such as those of Jessop (1998), Mayntz (2005) and Stoker (1998) stress the idea that governance consists in practices, methods and processes (formal and informal) based on collective action amongst interested parties with different but legitimate visions converging on shared objectives and the quest for common wellbeing. Further, this form of governance was regulated by criteria of organisation, efficiency, transparency, participation and responsibility or accountability, as set out in the White Paper on European Governance (European Commission, 2001). Like a prism seen from different angles, the study of governance has followed a development that has diversified the concept, adopting different emphases in a wide range of modes, levels and areas; for example: corporate governance (the initial use of the term, appearing before its application to the public sector to refer to efficient company management through shareholder participation: Aguilar, 2010), network governance, and other labels coined according to the object or area of analysis, like urban, environmental, maritime and mining governance, etc. (Bevir, 2012; Bustos et al., 2019; Glückler et al., 2019; Kooiman, 2005; Lemos and Agrawal, 2006; Peters, 2014; Peters and Professor, 1996; Rhodes, 1996; Stojanovic and Gee, 2020).

2.2. Seeking governance typologies

In an attempt to organise this proliferating terminology, various studies set out to go beyond single-dimension definitions by developing typologies or models for systematic classification. This wide range of assignations extends across a continuum of types of authority ranging from institutional autonomy or self-government (directive, vertical and unilateral) to public-private networks, (self-organising, horizontal and multilateral). This spectrum also ranges from clearly-demarcated roles in a single authority to more diffuse and open ones amongst different actors, and is at the same time a temporal continuum ranging from the long-term, permanent institutional view to the short term of management in public administration (Glückler et al., 2019).

We find examples in Steurer's four modes of governance (Steurer, 2013), identified according to the various possible combinations of government, market and civil society: public co-management/legal governance; public co-regulation/market governance, private co-regulation/private governance and tripartite co-regulation or network governance. Howlett and Ramesh (2014) expand this classification, dividing it into 12 governance modes, network governance being the mode with the greatest possible number of three-way combinations. Thus the concept of governance enables a greater analytical operativity, identifying different types of networks in line with their objectives and context of origin, with efficacy varying accordingly (Kenis and Provan, 2009; Provan and Kenis, 2008). These networks of interaction amongst actors with different social positions and power of influence have a structure close to that of interactive governance, since they share a systemic concept and are both connected to network theory (Jones et al., 1997).

2.3. Governance for efficiency and efficacy in management, and criticism of it

A large part of the popularity of the term 'governance' is based on its emphasis on efficient management in contrast to hierarchical, traditional and at times less efficient forms of authority (Peters, 2014). Both 'inclusive' and 'network' governance' have been used in a quasi-technocratic sense, characterised by aseptic or neutral co-operation. How can *a priori* self-organising networks be organized, however? What functions do each of their actors perform? How are decisions made? How can this governance be assessed?

Aside from this, since there is scarce empirical evidence and considerable ambiguity in the academic debate, associating inclusive or network governance with efficiency seems more an act of faith than a matter of proven fact (M. Howlett and Ramesh, 2014; Jones et al., 1997; Newig and Fritsch, 2009). It requires us to assume that inclusive governance, simply by being inclusive, ensures greater efficiency than traditional forms of self-government. The efficacy of network governance, related to its economies in transaction costs (Mayntz, 2005), becomes a tautology which is difficult to maintain and questionable due to its ambiguity (Peters, 2018; Provan and Milward, 1995). In this respect, greater advances have been made in policy network analysis (Bevir, 2010; Kenis and Provan, 2009; Knoke, 2014; Provan and Kenis, 2008), policy design (Michael Howlett, 2019), and studies of the relations between corporate governance and economic performance (Claessens, 2006).

This critical approach to the idea of "more governance and less state" (Kooiman et al., 2008) has given rise to an argument for the role of the state as facilitating helmsman or coordinator, capable of steering towards the common objective for which the various actors are co-operating (Pierre and Peters, 2000). Political movements have also emerged that highlight the verticality of power relations in some sensitive public policy areas such as health and education (M. Howlett and Ramesh, 2014; Erik-Hans Klijn and Koppenjan, 2012). Another unaddressed criticism is related to the theoretical background of governance, as it appears distant from democratic theory and does not include the accountability governments are normally subjected to (E. H. Klijn and Skelcher, 2007; Pierre and Peters, 2000; Sáenz, 2012) and which seems to be diluted in horizontal cooperation networks (Mayntz, 2005). Although network governance may be recognised as more pragmatic in its representation of interests, none of the actors alongside the government enjoys the same democratic legitimacy, and they also risk reproducing corporate processes and practices that neither transparency nor enhanced receptivity can counteract (Rhodes, 2005).

2.4. Meta-governance

In response to this poorly defined landscape of unresolved roles and issues, the need for a higher-level, reflective type of governance has emerged: an organisation of organisation itself (Jessop, 1998), or meta-governance, relating to the values and behavioural rules driving the actors involved (Kooiman, 2003). No longer a "game under certain rules" but now a "game about the rules" (Stoker, 1998), meta-governance foregrounds key questions such as the role of the state (as source of regulation and guarantor of coherence) and how each actor's power and influence are distributed in the play of interactions (an as yet unanswered question: Torfing et al., 2012). The most recent advances have been in the realm of new concepts such as social innovation or collaborative innovation, coined by the new public management current and drawing on the creative potential of meta-governed network governance (Erik-Hans Klijn and Koppenjan, 2012; Eva Sørensen, 2014; Stevens and Verhoest, 2016).

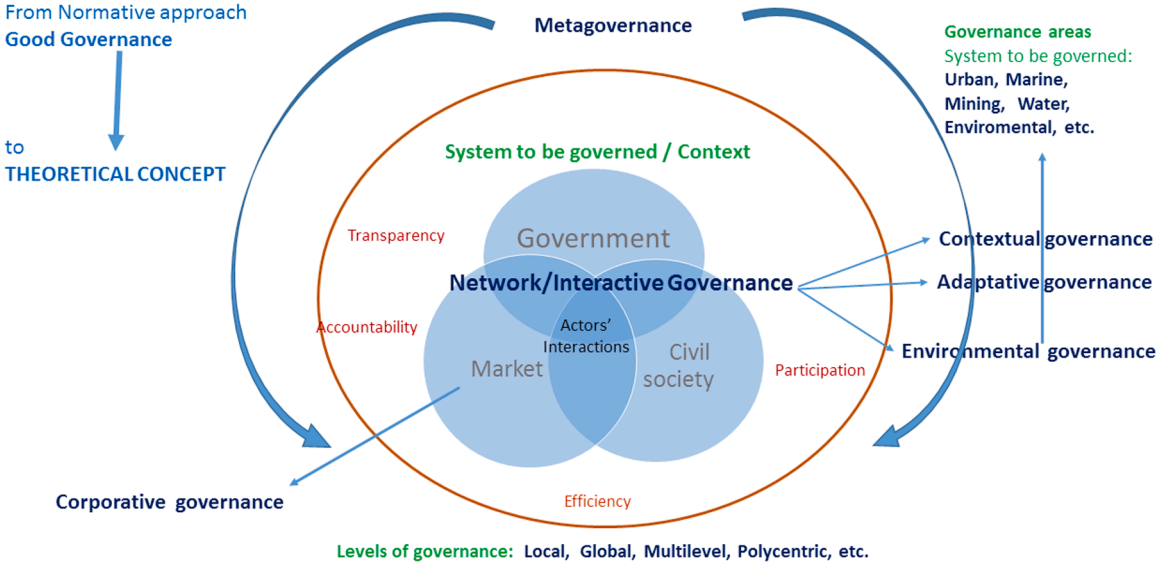
2.5. Towards a "governance of"

In the last twenty years, the concept has diversified. The literature attributes this to the growing importance of specific contextual features and their decisive influence on the ground (Bustos et al., 2019; Dasí, 2008; Gallach, 2008; Glückler et al., 2019; Michelini, 2010; Sal-as-Bourgoin, 2019). From this context-specific type of governance, fields such as ocean governance, marine governance, water governance, mining governance etc. have emerged. We would also include in this line the more popular concept of environmental governance, which envisages a scaled type of governance operating on different political-institutional levels, combined with network governance or polycentric governance for addressing environmental issues (Bulkeley, 2005; T. H. Morrison et al., 2019; Tiffany H. Morrison, 2017). At the same time contexts with challenges for sustainability have aroused interest in adaptive governance (Karpouzoglou et al., 2016; Schultz et al., 2019), which applies the essential features of network or interactive governance to contexts with environmental issues of degradation, deforestation, etc., recasting these as opportunities for "adaptive co-management" (Folke et al., 2005). In this view, the roles of the actors are conditioned by their knowledge of the object of governance, by their ability to learn and by their flexible adaptation to the management structure. The graph 1 systematizes this theoretical development of the governance concept.

3. Method

In order to explore the issue of governance in the mining industry in both its theoretical and applied aspects, a meta-analysis was performed of the content of 186 bibliographical references (BR from here on), comprising books, book chapters and articles in academic journals (Ngulube, 2020). This sample was the outcome of a general search in the SCOPUS database "keywords" field for the combined keywords of "mining" and "governance". Thus both the authors' keywords (provided by the authors of the documents) and the indexed keywords (provided by publishers, and including synonyms, spelling variations, plurals, etc.) were included in the search. Hence it was possible to omit the title from the main search field and facilitate the treatment of the raw data from the search, with a view to importing it with the network analysis program. Following this the results were filtered manually, eliminating irrelevant BR. For example, BR on "data mining" in IT engineering were excluded, since they discussed issues unrelated to the study objective. The BR sample was analysed in two phases. First, a general description of "governance" in mining studies was undertaken. To this end an automatic content analysis was performed using Atlas.ti (Woolf and Silver, 2017; Bryant and Charmaz, 2019) for the total set of raw data, namely the abstracts of the 186 references. The main results of this were:

- A frequency count of the words in the hermeneutic units after logical exclusion criteria were applied. For example, words such as "mining" and "governance" were excluded (as they were the original search terms), along with high-frequency grammar words such as adverbs, articles, forms of the verbs 'be,' 'have,' 'can,' 'do/make,' etc. Following application of these criteria, the first quartile of the word frequency distribution was chosen, with the objective of focusing the analysis as closely as possible on the most significant semantic elements of the hermeneutic unit.
- A co-occurrence analysis. This analysis was performed by automatically coding the whole hermeneutic unit. The frequency distribution explained above was used to define the codes. Thus, for example, for the code "sustainability" the application was instructed to select all phrases (the phrases are termed "context units" in the content analysis method; Kreuter, 2021) containing words such as "sustainability" and "sustainable" and the assignation of the code "sustainability." If the code "development" was found in the same context unit (phrase), then there was co-occurrence between these two codes, "sustainability" and "development". After completing the



Graph 1. Modes of governance.
Source: created by the authors.

coding of the hermeneutic unit, a manual revision of the automatic process was carried out, yielding a total of 139 different codes for the raw content of the BR.

The second phase of the analysis sought a more explanatory outcome and specifically focused on the keywords of the 186 BR, aiming to produce a graphic representation of the semantic structure of the literature (Leetaru, K., 2011). This graphic representation was obtained using VOSviewer (N. J. van Eck and Waltman, 2018), a program specifically designed for BR analysis, which treats each reference as an item in its entry matrix. The structural-semantic analysis drew on the cluster analysis that VOSviewer uses as its base. Clusters are created from the co-occurrences of keywords in each BR (N. van Eck and Waltman, 2009). Thus for example we can say that any two keywords co-occur when they appear in the same BR. The more frequent the co-occurrence of two keywords, the greater strength of association the program assigns to them. When data is uploaded, VOSviewer requests a series of operating parameters; thus, as the most efficient solution, a minimum of 3 co-occurrences between each pair of keywords was set for their inclusion in the analysis. The keywords "governance" and "mining" were also eliminated, together with "extractive industries" (since it was a synonym) and "data mining" (since it was not relevant to the study). The result was 91 keywords for which the program calculated the total strength of co-occurrences. Lastly, for the final outcome the co-occurrence coefficients were not normalized. The VOSviewer users' manual recommends normalization to eliminate the influence of *a priori* reasons explaining different indices of co-occurrence. However, the only *a priori* explanation of co-occurrences in this case were the different topics in the various fields of knowledge; that is, we expected the strength of association (co-occurrence) between keywords to be determined by the field of knowledge of the particular study, and thus the publication. Thus it was decided not to normalize the data in order that the conceptual structures reflected in the graphics would respond directly to the research question, independently of the scientific area of the studies. Graph 2 offers an overview of the methodological process.

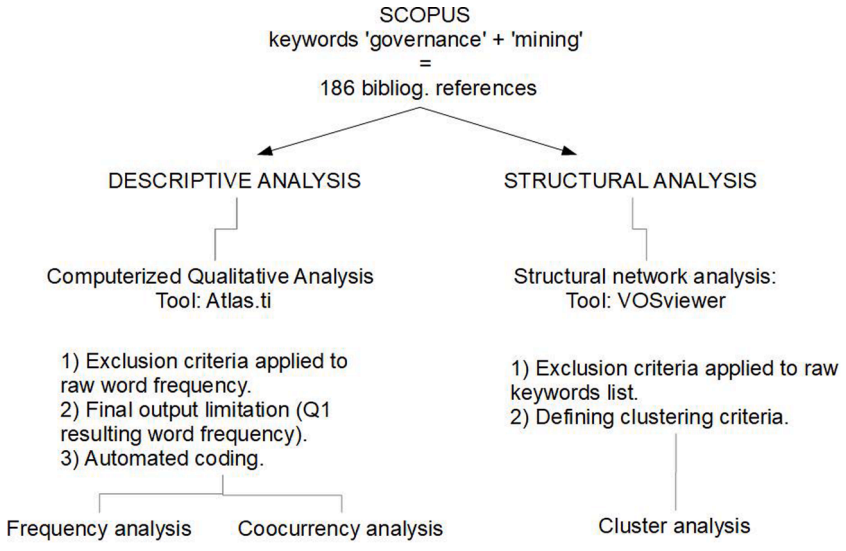
4. Results

The general analysis of the BR word frequencies (Table 1) revealed a set of ideas associated with the complex contemporary concept of the environment, with its ecological, social, political (policy, government, state) and economic dimensions, and strongly linked to the idea of development. A word set was also found relating to corporate management, both in its purest managerial forms and in its political sense (of managing power and decision-making). There was also frequent occurrence of terms linked to contemporary values such as sustainability and transparency, increasingly included in the industry's strategic and ethical ideology. Thus at first sight, the concept of governance found in the BR united semantic elements of classical sustainable development with new ones based on ethics in industrial performance, such as transparency (e.g. the EITI or Extractive Industries Transparency Initiative) and the consideration of environmental impacts. Also of interest was the emergence of geographical issues, more specifically the issue of the "local," which may indicate the importance of specific

Table 1
Most frequent words in the 186 BR abstracts (first quartile, exclusion criteria applied).

Word	Freq
environmental	240
social	180
development	176
policy	154
corporate	139
management	109
government	104
local	98
companies	95
transparency	93
global	86
state	84
africa	84
political	79
water	77
coal	77
economic	76
impact	74
eiti	67
performance	66
public	65
2019	60
sustainable	57
natural	55
2018	55
land	54
international	54
sustainability	53
csr	51

Source: created by the authors.



Graph 2. Diagram of the methodological process.
Source: created by the authors.

Table 2
Coefficients of co-occurrence.

	Africa	Coal	Companies	Corporate	CSR	Development	Economy	EITI	Environment	Global	Government	Impact	Local	Management	Performance	Policy	Public	Social	State	Sustainability	Transparency	Water	Average
Africa	0.00	0.04	0.14	0.15	0.20	0.26	0.21	0.06	0.03	0.09	0.14	0.05	0.10	0.10	0.04	0.13	0.02	0.11	0.12	0.15	0.10	0.01	0.11
Coal	0.04	0.00	0.03	0.05	0.00	0.11	0.06	0.00	0.00	0.02	0.05	0.02	0.03	0.08	0.03	0.06	0.01	0.02	0.03	0.06	0.00	0.23	0.04
Companies	0.14	0.03	0.00	0.32	0.18	0.09	0.11	0.05	0.01	0.10	0.09	0.08	0.21	0.08	0.15	0.13	0.11	0.08	0.15	0.14	0.07	0.01	0.11
Corporate	0.15	0.05	0.32	0.00	0.41	0.11	0.18	0.01	0.02	0.03	0.08	0.11	0.14	0.11	0.29	0.09	0.05	0.26	0.12	0.21	0.05	0.00	0.13
CSR	0.20	0.00	0.18	0.41	0.00	0.10	0.16	0.01	0.00	0.01	0.11	0.08	0.08	0.11	0.10	0.08	0.02	0.28	0.09	0.19	0.03	0.00	0.11
Development	0.26	0.11	0.09	0.11	0.10	0.00	0.27	0.04	0.02	0.15	0.20	0.19	0.17	0.17	0.04	0.33	0.07	0.37	0.16	0.40	0.16	0.09	0.17
Economy	0.21	0.06	0.11	0.18	0.16	0.27	0.00	0.11	0.01	0.10	0.18	0.12	0.16	0.12	0.06	0.22	0.11	0.28	0.12	0.17	0.12	0.01	0.14
EITI	0.06	0.00	0.05	0.01	0.01	0.04	0.11	0.00	0.00	0.13	0.03	0.03	0.04	0.06	0.10	0.04	0.13	0.02	0.03	0.02	0.26	0.00	0.05
Environment	0.03	0.00	0.01	0.02	0.00	0.02	0.01	0.00	0.00	0.00	0.02	0.00	0.02	0.03	0.01	0.00	0.00	0.01	0.00	0.04	0.00	0.10	0.02
Global	0.09	0.02	0.10	0.03	0.01	0.15	0.10	0.13	0.00	0.00	0.10	0.09	0.03	0.07	0.01	0.18	0.05	0.10	0.13	0.10	0.16	0.02	0.08
Government	0.14	0.05	0.09	0.08	0.11	0.20	0.18	0.03	0.02	0.10	0.00	0.16	0.34	0.20	0.03	0.29	0.18	0.29	0.19	0.10	0.12	0.01	0.14
Impact	0.05	0.02	0.08	0.11	0.08	0.19	0.12	0.03	0.00	0.09	0.16	0.00	0.18	0.13	0.05	0.13	0.12	0.11	0.07	0.11	0.08	0.08	0.10
Local	0.10	0.03	0.21	0.14	0.08	0.17	0.16	0.00	0.02	0.03	0.07	0.18	0.00	0.12	0.01	0.17	0.10	0.13	0.12	0.09	0.03	0.03	0.11
Management	0.10	0.08	0.08	0.11	0.11	0.17	0.12	0.04	0.03	0.07	0.20	0.13	0.12	0.00	0.06	0.13	0.07	0.20	0.06	0.07	0.07	0.10	0.10
Performance	0.04	0.03	0.15	0.29	0.10	0.04	0.06	0.10	0.01	0.00	0.03	0.05	0.01	0.06	0.00	0.06	0.07	0.09	0.02	0.06	0.04	0.01	0.06
Policy	0.13	0.06	0.13	0.09	0.08	0.33	0.22	0.04	0.00	0.18	0.29	0.13	0.17	0.13	0.06	0.00	0.12	0.34	0.17	0.13	0.14	0.08	0.14
Public	0.02	0.01	0.11	0.05	0.02	0.07	0.11	0.13	0.00	0.05	0.18	0.12	0.10	0.07	0.06	0.12	0.00	0.12	0.04	0.06	0.10	0.02	0.08
Social	0.11	0.02	0.08	0.26	0.28	0.37	0.28	0.02	0.01	0.10	0.29	0.11	0.13	0.20	0.09	0.34	0.12	0.00	0.13	0.36	0.12	0.04	0.16
State	0.12	0.03	0.15	0.12	0.09	0.16	0.12	0.03	0.00	0.13	0.19	0.07	0.19	0.07	0.02	0.17	0.04	0.13	0.00	0.05	0.07	0.00	0.09
Sustainability	0.15	0.06	0.14	0.21	0.19	0.40	0.17	0.02	0.04	0.10	0.10	0.11	0.09	0.07	0.06	0.13	0.06	0.36	0.05	0.00	0.11	0.00	0.13
Transparency	0.10	0.00	0.07	0.05	0.03	0.16	0.12	0.26	0.00	0.16	0.12	0.08	0.03	0.07	0.04	0.14	0.10	0.12	0.07	0.11	0.00	0.00	0.09
Water	0.01	0.23	0.01	0.00	0.00	0.09	0.01	0.00	0.10	0.02	0.01	0.08	0.03	0.10	0.01	0.08	0.02	0.04	0.00	0.10	0.00	0.00	0.04

Source: created by the authors.

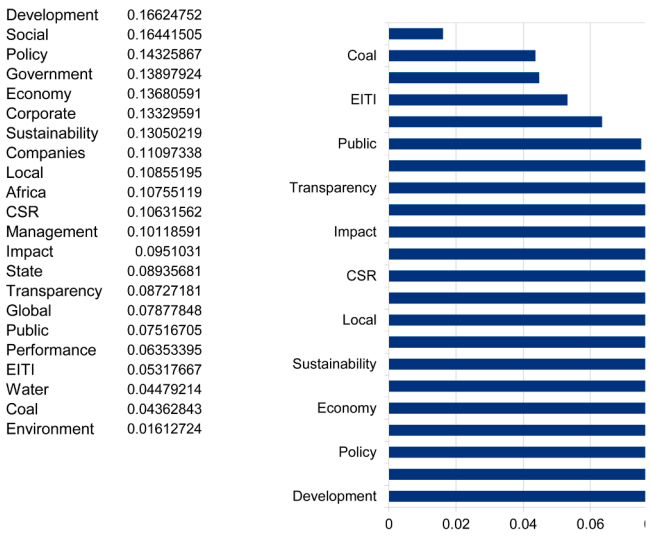
geographical features and territorial factors in the definition of governance applied to the mining industry.

Table 2 and Figure Graph 1 and Graph 3 afford a general overview of the relationships between the most cited concepts in the data set. This reveals the composition of the concept of governance in its application to the mining sector, in terms of both its structure and complexity of meaning. Hence we observe that it referred to environmental factors, but with more social, political and economic significance than simply "natural" or ecological in the older sense. "Development," "social," "policy," "government," "economy," "corporate," and "sustainability" were the elements relating most strongly to the rest (all over 0.13). The second most frequent group included clear references to corporate management ("companies," "management," "impact," "performance") within an ethical framework ("transparency," "EITI," CSR"), at the same time giving importance to geographical or more specifically geopolitical elements ("local," "global") and to the role of the state or public administration in governance ("state," "public"). The general table of co-occurrences offers a detailed image of the concept in the way it is used in the mining sector, which for reasons of space we cannot discuss in depth here. Thus for example, observing the coefficients of "development," we see its close links (high co-occurrence) with the above-mentioned social, political and economic factors, with particular stress on sustainability (co-occurrences over 0.20).

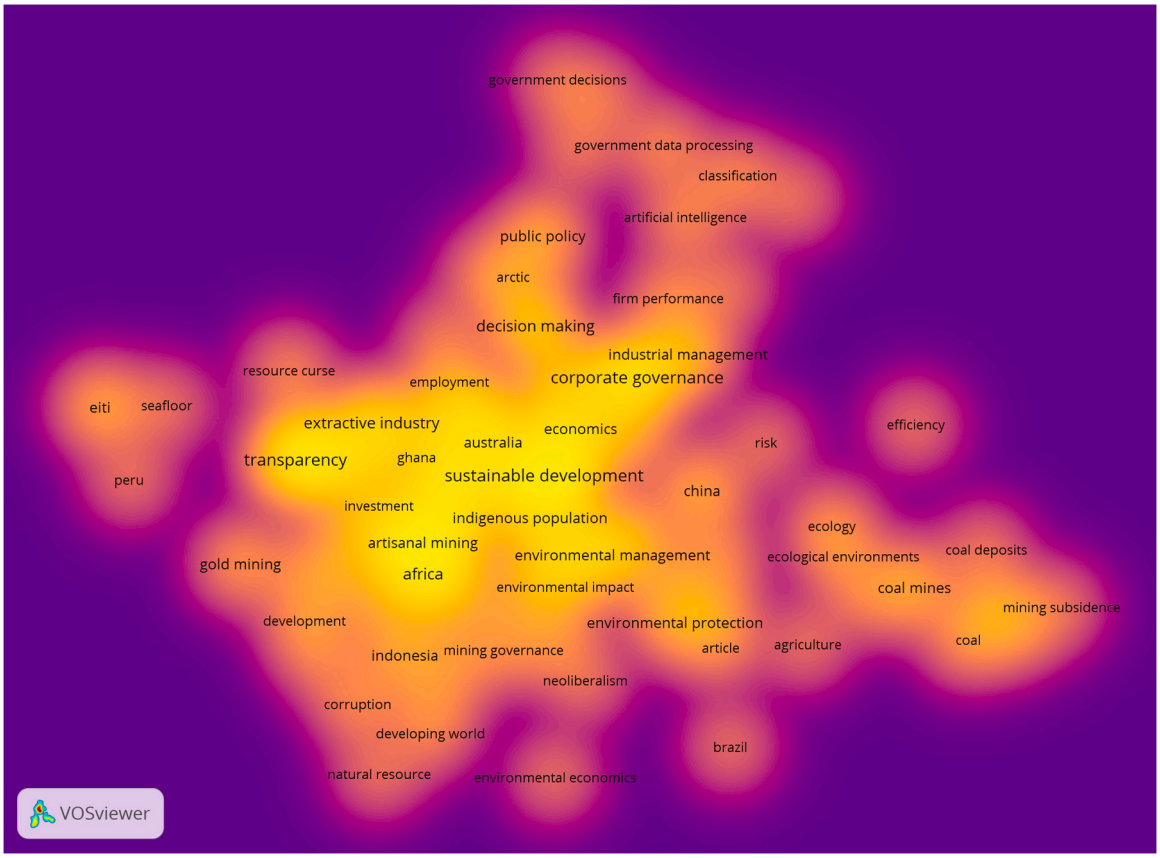
In the second part of the analysis, a *multidimensional semantic model* was produced by the program used.

In this density map, created by VOSviewer (Graph 4), the colour of each point on the map depends on the quantity and importance of the surrounding items. Thus the map gives a structural view of the whole set of items. In this case, it registers the relative weight of the keyword concepts from the whole set of meanings associated with "governance" in mining. Mainly this involved the concepts found in the theory of governance; thus the most important of these, "sustainable development" and "corporate social responsibility," are very close together on the map, which highlights their mutual semantic dependence in the collective discourse of "governance in mining."

The central area of the map shows the salience of concepts associated with corporate management ("corporate strategy," "management" and "investment," for example), and specifically the relationship of the company with its setting ("environmental management," "stakeholder," "environmental impact assessment," "local government," etc.). As we widen the focus, we observe concepts linked to contemporary corporate management values, and closely related to the description of governance as "good governance," ("transparency," "accountability"), or rather to



Graph 3. Mean co-occurrence.
Source: created by the authors.



Graph 4. Density map (keywords).
Source: created by the authors.

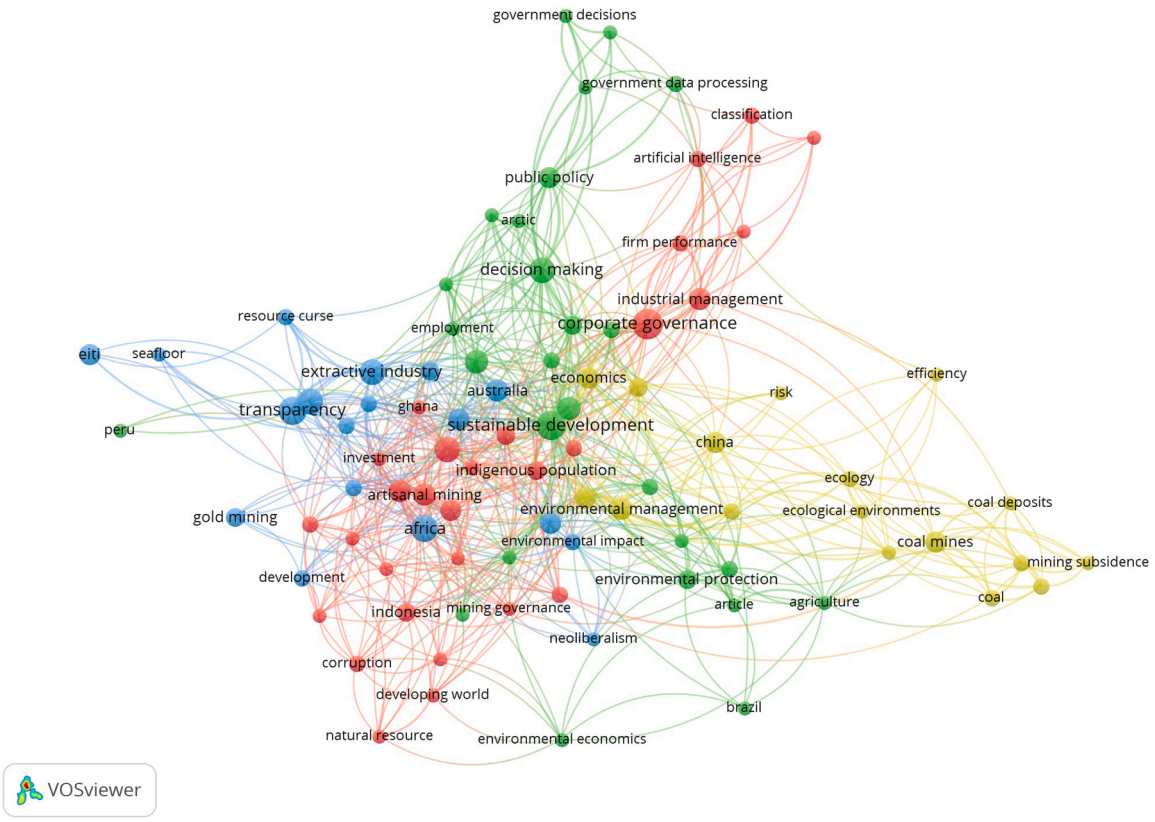
the basic principles of governance. Also we notice others that are both methodological or practical and strongly social ("participatory approach," "community development").

In pursuit of the most efficient multidimensional model, the VOS clustering method was adjusted by assigning a minimum number of 17 items per cluster, thereby producing a graph that expressed the best balance between the three basic elements of any structural analysis: a discrete number of clusters (offering the most powerful explanation with the lowest number of clusters); the internal semantic coherence of each cluster (affording solidity and stability); and the differentiation of each cluster from the rest (facilitating distinction amongst clusters). Each component or item (keyword in this case) appears in the graph 5 as a label and a circle (network node), its size corresponding to its importance (occurrence and density of relations). A total of four clusters was obtained:

1) The terms in the red cluster refer to a governance approach with corporate management connotations relating to strategy, investment, company performance and decentralisation. The BR in this cluster discuss policy and industrial regulation. Some significant examples of this cluster are studies analysing the importance of corporate governance structures in financial performance (Dzingai and Fakoya, 2017). The is notable attention paid to corporate governance as management policy, as an internal dimension of CSR, and as a positive influence on company finances. This is the case of the mining industry in India (Patro and Pattanayak, 2016, 2017) and Indonesia (Marwati et al., 2018), texts relating to which stress the positive relationship between CSR and the application of good corporate governance for profits, as reflected in financial reporting quality.

At times, particularly in the Indonesian example, "good" governance is defined from an ethical perspective. Hence typical management concepts such as *return on capital employed, return on equity, return on assets* and *FRQ (Financial Reporting Quality)* appear in relation to corporate governance as an independent variable, and more specifically to measures of corporate governance, such as independence and the size of the board of directors or executive committee, here again with positive effects on financial performance (Dzingai and Fakoya, 2017). We also observe terms relating to engagement with social actors (Lin et al., 2015) and to the disciplines of results reporting and operational sustainability (Patro and Pattanayak, 2016). In a more purely theoretical area, some references analysed conceptual innovation in governance, with the inclusion, for example, of "collaborative accounting" (Riter, 2019).

1) In the green cluster we observe a group of BRs linking governance closely to sustainable development, corporate social responsibility and environmental monitoring and protection. The upper area of the cluster clearly centres on decision-making and purely political factors (public policy, politicians, institutional framework, etc.). Thus these references relate government to the external performance (i.e. in the environment) of the mining company. Hence for example, the extractive industry is studied in relation to other economic activities in the same geographical area (agriculture and forestry) and to more purely social factors (population living standards, education, etc.: Balag'kutu, 2017). This further includes interesting references to national and continental development models based on the governance of primary resources, with a particularly important role attributed to state interventionism (Ambe-Uva, 2017), including on an international level, through the creation of regulation and



Graph 5. Clusters of keywords.
Source: created by the authors.

assessment criteria for sustainable development (Rungan et al., 2011).

In this cluster there also appears the concept of "transnational governance," aligned with global environmental governance, as key in boosting the potentially positive effects (and reducing the negative ones) of the mining industry in large-scale geopolitical areas (Auld et al., 2018; Mills and Sweeney, 2013), especially in the context of the global growth of the mining sector and its relations with the institutional structures of different political regions across the world. Such political-institutional factors in the mining context are referred to as "governance" in the literature, which widens the concept's field of application to include the relationships between various categories of stakeholders (companies, different levels of government, the third sector, etc.) and their power or influence in making operations sustainable.

1) The blue cluster yields important axiological models around which the other items in the cluster revolve. Thus "transparency" and "accountability" are the central terms, in this case formulated as values for good performance in mining. References were also found to technical processes such as "environmental impact assessment," although these were weighted with social and political meanings ("participatory approach," "regulatory framework," "community development"), and even ideological ones ("neoliberalism"). Significant examples of this cluster stressed values such as transparency, accountability and social participation in governance processes (or the absence of these: Djane, 2017; Pelaudeix et al., 2017; Rungan et al., 2011; Thompson et al., 2018), sometimes as a remedy for endemic ills such as corruption and overexploitation in certain geographical contexts, for example a study (Umejesi et al., 2018) calling into question the management of African mining companies for not embracing certain excluded social actors or viewpoints.

Many references discussed ambitious transnational governance mechanisms fomenting transparency as a basic value in governance and therefore also in mining performance (Poncian and Kigodi, 2018; Tissot, 2019), such as the Extractive Industry Transparency Initiative (EITI: Balag'kutu, 2017). Such discussions shed much light on the field, while at the same time leaving many grey areas, mainly due to lack of adaption to the SLO (Social Licence to Operate) and to historical, cultural and economic factors in specific contexts. Structural and cultural factors, such as institutional design, specific features of civil society, diversity and independence, condition both the application of these initiatives and their expected outcomes. Other references call for legal regulation (both national and international) and urge government action (Ambe-Uva, 2017; Ihugba, 2016; Leonard, 2017; Rungan et al., 2011).

1) The yellow cluster shows the most ecological aspect of governance in the mining industry, at the same time bearing clear references to the economic and strategic interest of this definition of governance. Its central items refer to elements of reflection, techniques, and environmental and natural management: "environmental governance," "environmental management," "ecology" and "ecological environments." In the same cluster, however, we also find "economics," "efficiency," "economic and social effects," "risks" etc., which have the combined meaning of "governance in/for environmental engineering." Thus in one subgroup numerous studies referred to "extractive governance" or the governance of natural resources (Bevir, 2012; Jessop, 1998), such as water, land, the landscape, etc., and even of minerals themselves like coal or gold (Campbell et al., 2017).

Another subgroup centred on the integration of the social and community dimension as a risk factor that should be assessed and incorporated through participation (Aguilar-González et al., 2018; Leifsen et al., 2017; Prior et al., 2012). Some studies, paradigmatic in

this cluster, sought to produce assessment systems for efficiency in mining, including environmental governance as a measure integrated with the other factors appearing (Yang et al., 2017), or ambitious integrated strategic management plans for promoting positive economic, ecological and social impacts; this was termed "integrated governance" (Jiang et al., 2019). There were also more restricted but clearly engineering-based approaches (Wang et al., 2014) adopting a flexible idea of governance, referred to as "geological environmental governance."

5. Discussion

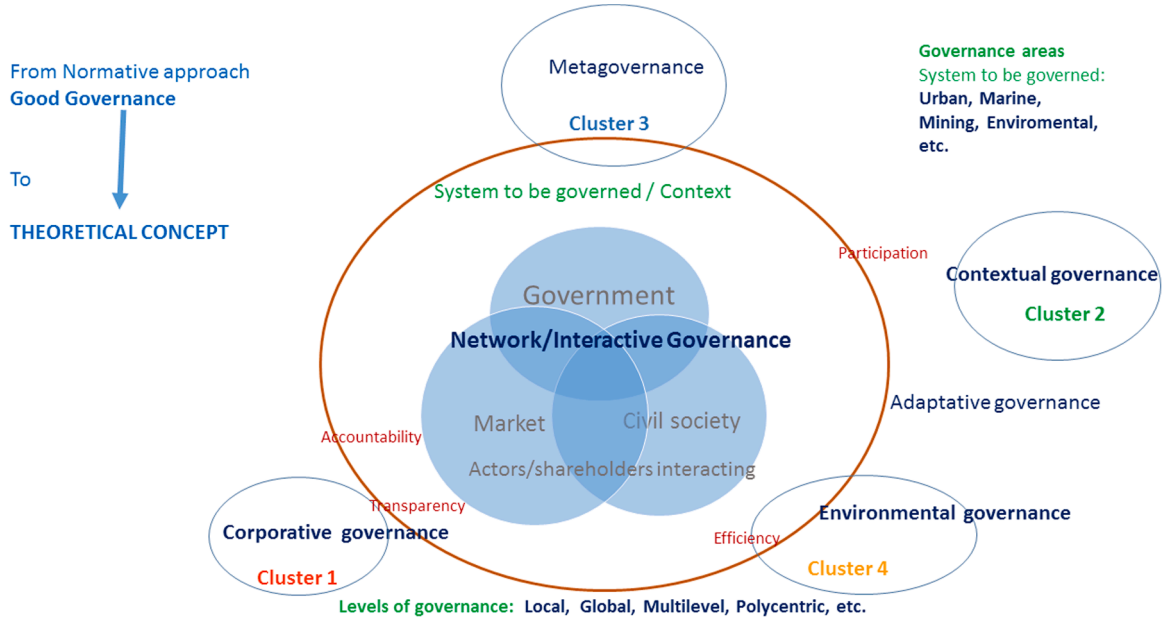
In the light of the results presented here, the general form in which the concept of governance is understood in mining is rooted in the complexity of the environment in its contemporary sense (multidimensional), combined with the idea of sustainable development. At the same time, governance is seen as key for industrial management and performance with ethical overtones, and connected to the territory in its most complex and multidimensional aspects (population, resources, socio-political relationships, etc.). The concept of governance in the mining industry is loaded, then, not only with social, political and economic meanings but also with environmental ones, in addition to that of responsible contemporary management.

The more in-depth analysis revealed a theoretical system composed of four clusters of ideas with a certain internal consistency, but which were also complementary and, of course, partially overlapping. This means that we do not find strictly pure submodels in the definition and application of the concept in mining and related studies. In the semantic structure unveiled, the four clusters are not mutually exclusive, but often share nodes (ideas and dimensions) connecting them. This means that governance in the mining sector reflects, firstly, the same pragmatic versatility shown by the general concept and history of governance and, secondly, the flexibility of usage of the concept even in the literature specialised in political management (Colebatch, 2014). Nevertheless, as the detailed description of the four clusters highlighted, particularities in each of them can be discerned, bearing more concretely on the specific vision, mode or approach to governance distinguished in our theoretical explanation.

Graph 6 shows a logical juxtaposition between the clusters and the previously presented graphic representation of the debate around governance. The first cluster (red) sees governance in terms of the internal performance of mining enterprises as companies and is clearly restricted to the concept of corporate governance. This is the original governance approach (Aguilar, 2010): corporate governance as a style of company management, related therefore to the distribution of authority and its efficient exercise, and drawing on theories of organisation and costs. The literature here refers to management practices based on principles of participation or transparency as desirable for good corporate governance for better financial performance.

The second cluster (green) is orientated towards the same topic, but in terms of external performance, as governance conditioned by the nature of the context and the object of governance itself (the system to be governed). This cluster is closer to the analysis of contextual or territorialised governance; it involves awareness of the conditioning effects of the socio-political context on the company, which seeks instruments for fitting the mining enterprise to contextual demands in order to find solutions for the management of both social and environmental risks (Glückler et al., 2019). Studies such as those by Sauer & Hiete (2020), with multi-stakeholder initiatives (MSI), or Boutilier (2020), Cheshire (2010), Cheshire et al. (2014), Sairinen et al. (2021) show that non-governmental actors (communities and the third sector, mainly) and instruments such as the SLO (social licence to operate) are gaining increasing importance in this network of influences (Lesser et al., 2020; Prno and Scott Slocombe, 2012). The play of influences amongst actors, in relation to environmental problems, brings this cluster close to the notion of polycentric governance (T. H. Morrison et al., 2019), in which we see a global environmental governance that is aware that not all actors have the same decision-making power. These two first clusters reflect the most important semantic dimensions for the whole set of data, as they encompass 61.5% of all references, and their most important components define the core concept of governance in the literature on the mining industry. This representativeness indicates that governance in the sector arrived through the original, company-based concept, which adopts a bottom-up perspective stemming from the context.

The third cluster (blue) sees governance as a value, and connects it to a value system that is ideal for good performance in mining (socially and environmentally respectful, ethical, sustainable, just, transparent, etc.), while also alluding to the key role of the state as part of this good governance, and implicitly to what was defined above as meta-



Graph 6. Overlapping clusters and modes of governance.
Source: created by the authors.

governance. Apart from the links that this cluster has with contextualised governance (associated with cluster 2, green), we also find the appeal to one of the key actors in mining governance, and the key actor in governance theory: the state. Historically, in the first theories on governance (Rhodes, 1996), and more specifically in the field of corporate governance, the government was assigned a minimal role. However, studies such as those of Rungan (2011), Leonard (2017) and Ambe-Uva (2017) highlight the state as the key arbiter for good governance in the extractive industries, or at least as a dominant network actor (Pierre and Peters, 2000). This attention to substantive principles of governance and the play of roles in interactive governance, with the recuperation of the government's role, situate this cluster close to meta-governance theory (Sørensen and Torfing, 2018; Torfing et al., 2012). Implicitly, meta-principles of governance are advocated to guide actors' behaviour (Kooiman, 2003).

The fourth cluster (yellow) flexibilises the idea of governance to bring it into the field of environmental engineering for efficiency in mining, directly linking it to the primary notion of governance as the most effective management tool. We can understand it as adjectival/extractive governance. The main feature of this cluster is the use of governance as a strategic tool, effective in the complex management of natural resources and environmental problems. This cluster is not clearly associated with any of the previously discussed modes, but gives importance more specifically to the principle of efficacy in governance. Thus the application of governance is based in its *a priori* value as an effective management style, consecrated in theory (Bevir, 2012; Jessop, 1998; Mayntz, 2005) but with weaknesses on the empirical level (Peters et al., 2018), and also with ambiguities concerning the possibilities of accounting for efficacy from different points of view (corresponding to the social actors involved).

In the identification of these clusters, overlapping but associated to different modes of governance, we can also discern some erratic uses of governance theory concepts. The wide use of the concept of good governance is still found in the prescriptive sense, referring to how political management in mining "should be," i.e. including criteria of transparency and social participation – when these are already substantive principles of the concept. There are also references to network governance from the standpoint of a social network analysis approach (Das et al., 2019), or identifying only buyers and suppliers as interested actors (Statsenko et al., 2018); thus these limit the meaning of network governance, which ideally should involve all stakeholders, and particularly the least privileged local actors and indigenous communities, often seen as "resource guardians" (Broomes, 2013), and fundamental to the execution of a mining governance that contributes to sustainable development.

In recent years it has been precisely this social dimension that has been one of the main concerns in mining governance, once it was realised that mere compliance with regulatory instruments was not enough (Moffat and Zhang, 2014). There is much work to be done in this line of research, however, particularly in assessing to what extent the use of governance and the application of regulatory or engineering-based instruments goes beyond mere "ethical washing" of the extractive industry's image.

6. Conclusion

This study shows that the concept of governance in the mining industry reflects, to equal extents, both complexity and polysemy. The industry assumes governance as key for the environment and, as a consequence, for its business. Intervention in this environment is increasingly seen as complex, difficult and hazardous, and for this reason the sector tends to embrace modes of understanding it and incorporating environmental particularities (natural, social and political) into the internal and external management of mining activities. The negative external effects of the industry have obliged it to rethink corporate governance beyond internal business management, until recently (and perhaps still today) centred solely on economic efficiency. The sector has become aware, therefore, of the complexity of both the system to govern and the governing system (Kooiman et al., 2008), and also of the need to take these into account, not only from the point of view of efficiency but also that of conflict, legitimacy and social justice (Aguilar-González et al., 2018; Lemos and Agrawal, 2006). Such terms can be tragically verified in the recent disasters of Mariana (2015) and Brumadinho (2019), which underline the practical limitations for introducing new governance formulas in mining management. Thus, this article is intended to be useful to both the mining sector and academia. The mining sector will be able to locate its corporate performance in terms of the management of power relations, once the different clusters resulting from the analysis are observed. At the same time, it also offers a general overview of the concept of governance and its historical evolution, which aims to be transdisciplinary and affordable for both professionals and researchers in any area of knowledge. Additionally, for academia, a general perspective of the diversity of governance approaches and uses is offered, in order to facilitate their use in research and their own interests. Graph 2, Graph 4, Table 1.

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