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ORIGINAL ARTICLE

Corporate governance aspects in sustainability and performance assessment models for energy companies: a systematic review of the literature

Aspectos de governança corporativa em modelos de avaliação da sustentabilidade e desempenho para empresas de energia: uma revisão sistemática da literatura

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Abstract: The present study aims to map the sustainability and performance evaluation models for energy companies regarding their qualitative and quantitative aspects of corporate governance. This research was carried out through a systematic literature review and the establishment of connections between the issues raised and general aspects of corporate governance, vis-à-vis the sustainable development matter. Aspects of corporate governance, such as gender diversity in the creation of boards of directors and directors in companies, is relevant in view of the UN Sustainable Development Goals, as well as the ISO 26000 standard, regarding guidelines on corporate social responsibility. As an innovation in this mapping, a summary of the main qualitative and quantitative aspects of corporate governance is carried out using the clustering technique and co-occurrence map, mining and text analysis, compared to sustainability and performance evaluation models for energy companies. At the end, gaps in these models are pointed out referring to national and international organizations and studies regarding intersectoral principles, practices and tools of corporate governance; opportunities for improvement are also pointed out.

Keywords: Corporate governance; Sustainability; Evaluation model; Performance; Energy sector.

Resumo: O presente estudo visa mapear os modelos de avaliação da sustentabilidade e desempenho para empresas de energia quanto aos seus aspectos qualitativos e quantitativos de governança corporativa. Esta pesquisa foi realizada por meio de revisão sistemática da literatura e o estabelecimento de conexões entre os assuntos levantados e aspectos gerais de governança corporativa, vis-à-vis à questão do desenvolvimento sustentável. Aspecto de governança corporativa, como a diversidade de gênero na formação de conselhos de administração e diretorias em empresas, mostra-se relevante frente aos Objetivos de Desenvolvimento Sustentável da ONU, bem como, o padrão ISO 26000, a respeito das diretrizes sobre responsabilidade social corporativa. Como inovação neste mapeamento, realiza-se uma síntese visual dos aspectos qualitativos e quantitativos principais de governança corporativa com o uso da técnica de *clustering* e mapa de co-ocorrência, de mineração e análise de textos, frente a modelos de avaliação da sustentabilidade e desempenho para empresas de energia. Ao final, são apontadas lacunas desses modelos com referência a organismos nacionais e internacionais e estudos no que diz respeito a princípios, práticas e ferramentas intersetoriais de governança corporativa; são apontadas também, oportunidades de melhorias.

Palavras-chave: Governança corporativa; Sustentabilidade; Modelo de avaliação; Desempenho; Setor de energia.

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1 Introduction

This article's goal is to map the quantitative and qualitative aspects of Corporate Governance (CG), such as: gender diversity in the board of directors' members, the existence of an anticorruption policy, the number of judicial processes, etc., considered in models that evaluate sustainability and performance for energy companies compared to a systematic literature review. Usually, the models consider economic, social and/or environmental aspects, such as the Triple Bottom Line, for example.

In September, 2015, 193 UN Member States (UN General Assembly Resolution 70/1) adopted the "2030 Agenda" for Sustainable Development, after a global participative process of governments, civil society, private sector and research institutions. Its implementation began in January, 2016, continuing the Millennium Development Agenda (2000-2015) and amplifying its scope. The 2030 Agenda includes economic development; ending poverty, misery and hunger; social inclusion; environmental sustainability; and good governance on all levels, including peace and safety. The agreements are present in 17 goals (Sustainable Development Goals, SDG) and 169 global action goals to be reached by 2030. Aiming to monitor the objectives and goals, 254 indicators were established, not all of them applicable to Brazil (position in 18/01/2022). In general, for example, there are aspects related to governance, such as gender equality, represented by indicator 5.5.2: proportion of women in managerial positions (ODS Brasil, 2022a, b). Although these 17 SDGs are supported by 169 more tangible goals, most of them are still relatively vague. Most of these goals are purely qualitative, leaving a lot of room for interpretation. For this reason, it is important to materialize the SDGs as much as possible through the proper indicators, combined with commitments formalized by governments on a national level (Biermann et al., 2017).

Organizations all over the world, as well as its interested parties, are becoming more aware of the necessities and benefits of socially responsible behaviour. Therefore, having social responsibility, that is, an organization's responsibility for its decisions and activities' impacts on society and on the environment through an ethical behaviour, contributes to a sustainable development. The organization's performance compared to the society it operates in and its impact on the environment have become a critical part of its general performance evaluation, and its ability to work efficiently. This partially reflects the acknowledgement of an ever-growing necessity to ensure healthy ecosystems, social equality and good corporate governance (ABNT, 2010). Therefore, for example, connecting climate change to structures of sustainable development's governance is vital to avoid damaging trade-offs in any direction, but also presents an alluring and considerable opportunity to mutually improve the results to deliver a better world until 2030 and beyond (Nerini et al., 2019).

Still according to ABNT (2010), Corporate Governance is the system through which an organization makes and implements decisions in an effort to achieve its goals. Corporate Governance can comprise both formal governance mechanisms, based on defined structures and processes, and informal mechanisms, that emerge through the organization's culture and values. It's a crucial function of every type of organization, like the decision-making structure is. The governance systems vary, depending on the size, the type of organization, and on the environmental, economic, cultural, and social context under which they operate. They are driven by a person or a group of people (owners, advisors, associates or shareholders, members or others) and have authority and responsibility in the quest to reach the organization's objectives. Furthermore, an efficient governance must have as its principles: accountability, transparency, ethical behaviour, respect for the interested parties' interests, respect for the rule of law, respect for the international norms of behaviour and respect for human rights.

Furthermore, governance aspects, such as leadership, establishing a culture of sustainability, strategic alignment of the company's programs and transparent direction, as examples, contribute to organizational sustainability and good performance. Governance best practices should also be considered, such as: promoting diversity and inclusion in the workforce, fair dissemination of information, separation of the positions of CEO and chairman of the board of director's, fighting corruption, etc. (ME, 2022; Nawaz & Koç, 2019; OCDE, 2016). According to Bonsu et al. (2020), the idea is for the participative governance processes to be bottom up and improve the SDGs discussion and public policies aiming to fulfil the 2030 Agenda. Furthermore, humanity lives more and more in a time when lone planners can't solve social problems and, because of that, they demand multisectoral approaches through society contributions. And Yu et al. (2020) point towards the importance of Integrated Reporting (IR), a report which includes a summary of the efforts the company can employ in approaching themes such as governance, strategic goals, financial and non-financial performance, along with a summary of its perspectives.

In Brazil, the National Electric Power Agency (ANEEL), through Normative Resolution #605, from 11/03/2014, approved the Electric Sector's Accountability Manual (ESAM). It was established, among other goals, the contribution to the optimization of the socio-environmental performance through the explanation of costs generated by the compliance with the Environment National Policy, necessary to the environmental and sustainable compliance of concessions attributed to the Federal Union, aiming to prepare the Social and Environmental Responsibility Report (SER). The ESAM reports more than two hundred quantitative and qualitative indicators relating to general dimensions, corporate, economic-financial, social and sectorial, and environmental governance, for companies with grants (generation, transmission and distribution of electricity) required or suggested by ANEEL. Corporate Governance includes the company's adherence to ethical principles and to transparency, to accountability and the values that rule over it (ANEEL, 2014, 2015).

This research has the following sections: Systematic literature review (2), searching for the main publications about the current theme; Other standards and studies (3), talking about the theme under the GRI standard view and ISO 26000, for example; and the Conclusions (4).

2 Systematic literature review

The systematic literature review was made in January, 2022, using data bases Scopus, Web of Science, Compendex, IEEE Xplore, Emerald Insight, Scielo, ACM Digital Library, EBSCO, Digital library of thesis and dissertations, Thesis and dissertations catalogue, and Wiley Online, for the 2000-2021 period, employing the ProKnow-C method (Knowledge Development Process – Constructivist) (Afonso et al., 2011; Ensslin et al., 2014). As a supporting software (publishing repository), StArt – State of the Art through Systematic Review, version 2.3.4.2, from LaPES (Laboratório de Pesquisa em Engenharia de Software), Computing Department, Universidade Federal de São Carlos (UFSCar) was used (UFSCar, 2021). Board 1 shows, as follows, a summarized version of the eight phases and its respective procedures used by ProKnow-C method, aiming to build a final bibliographic portfolio (BP5) through intermediate bibliographic portfolios (BP, 0 to 4).

Board 1. Systematic literature review.

PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8
Defining keywords for the research	Defining CAPES data bases aligned with the research	Defining research in title, summary and keywords from the publications on each data base	Counting the # of publications by axis and data base aiming to create the initial bibliographic portfolio (BP0)	Counting the # of BP1 citations on Google Scholar	Selecting most cited publications (85% of total citations)	Selecting less cited publications (15% remaining of the total of citations)	Gathering BP2, BP3 and BP4 publications
Defining research axis; creating boolean expressions (“and”; “or”)	Defining research filters (time period, subject, publication type, etc.)	Checking if the searched keywords are adhering to the publications’ keywords	Selecting publications that adhere to the research (readig the title); excluding repeated publications (BP1)	Categorizing publications in descending order of citations	Selecting publicatios that adhere to the research (reading the abstract) (BP2)	Selecting publications from the last 3 years that adhere to the research (reading the abstract) (BP3); Selecting remaining publications that have authors on BP2 and are that adhere to the research (reading the abstract) (BP4)	Selecting publications that adhere to the research (integral reading) in order to create the final bibliographic portfolio (BP5)

Source: Authors, adapted from Ensslin et al. (2014).

The following research *string* was used for the *abstract* field: *(“sustainability” OR “sustainable”) AND “performance” AND (“indicator” OR “indice” OR “index” OR “measurement” OR “assessment” OR “evaluation” OR “appraisal” OR “metric” OR “model” OR “framework” OR “template” OR “example”) AND (“energy companies” OR “electricity companies” OR “energy firms” OR “electricity firms” OR “energy industry” OR “power industry” OR “energy sector” OR “electricity sector” OR “electric sector” OR “energy enterprises”)*. This *string* translates the following research question: what is there about sustainability and performance evaluation model for energy companies?

In this case, a single axis of research was used (*string* previously shown). 763 articles were found (bibliographic portfolio BP0, Phase 4, according to Table 1) which, after repeated publications were excluded, titles and abstracts were read, using a “cutting point” (above it, minimum 85% of Google Scholar citations; below it, more recent articles, published in the last 3 years), integral reading of the remaining articles and verifying how adherent to the research they were, there were 58 studies left. Among these studies, 35 articles, in which there is some mention of Corporate Governance (CG), were selected. Of these 35, only 13 tackled CG’s qualitative or quantitative aspects; in other words, only 22.5% of that total of 58 selected articles talk about some aspect of CG. Table 1 shows the resulting number of publications in each bibliographic portfolio and its corresponding phase of the systematic literature review.

Table 1. Number of publications for each bibliographic portfolio. Source: Authors.

Bibliographic Portfolio (BP)	Phase	# of articles
0	4: search in the data bases	763
1	4: adhering (title reading); and non-repeated	129
2	6: most cited (85%) from BP1; adhering (abstract reading)	21
3	7: less cited (15%) from BP1, 3 last years; adhering (abstract reading)	37
4	7: less cited (15%) from BP1, authors in BP2; adhering (abstract reading)	2
5	8: BP2+BP3+BP4; adhering to the research (integral reading)	58

And Table 2 reports the final bibliographic portfolio (BP5) with thirteen studies.

Table 2. Final bibliographic portfolio. Source: Authors, adapted from Ensslin et al. (2014).

Author(s)	Title	Periodic	# of citations (Google Scholar)
Dube & Jaiswal (2015)	Corporate governance in the energy sector	Jindal Global Law Review	5
Ecer et al. (2019)	Sustainability assessment of OPEC countries: Application of a multiple attribute decision making tool	Journal of Cleaner Production	32
Herbohn et al. (2014)	Corporate Social Responsibility: The Link Between Sustainability Disclosure and Sustainability Performance	A Journal of Accounting, Finance and Business Studies (Abacus)	141
Gardazi et al. (2020)	Board of Directors Attributes and Sustainability Performance in the Energy Industry	Journal of Asian Finance, Economics and Business	5
Jarvis & Sovacool (2011)	Conceptualizing and evaluating best practices in electricity and water regulatory governance	Energy	38
Milojevic et al. (2020)	Impact of Non-Financial Factors on the Effectiveness of Audits in Energy Companies	Energies	4
Patari et al. (2012)	Does Sustainable Development Foster Value Creation? Empirical Evidence from the Global Energy Industry	Corp. Soc. Responsib. Environ. Mgmt.	97
Qi et al. (2020)	Corporate Governance-Based Strategic Approach to Sustainability in Energy Industry of Emerging Economies with a Novel Interval-Valued Intuitionistic Fuzzy Hybrid Decision Making Model	Sustainability	26
Salmi et al. (2019)	The need of Corporate Social Responsibility (CSR) Implementation in Energy Industry: Proposition Development	International Journal of Recent Technology and Engineering (IJRTE)	0
Shahbaz et al. (2020)	Board attributes, CSR engagement, and corporate performance: What is the nexus in the energy sector?	Energy Policy	41
Sueyoshi & Goto (2014)	Environmental assessment for corporate sustainability by resource utilization and technology innovation: DEA radial measurement on Japanese industrial sectors	Energy Economics	68
Xu & Chen (2019)	Exploring the relationships between environmental management and financial sustainability in the energy industry: Linear and nonlinear effect	Energy & Environment	10
Yang & Zhang (2020)	An evaluation of the green performance of chinese new energy enterprises from the perspective of social responsibility	Nature Environment and Pollution Technology	0

In Table 2, two recent (published in the last 3 years) articles with no citations on Google Scholar were considered, both aligned with the research theme and they both talk about corporate governance (Salmi et al., 2019; Yang & Zhang, 2020).

And Figure 1 shows the annual distribution of publications since 2011.

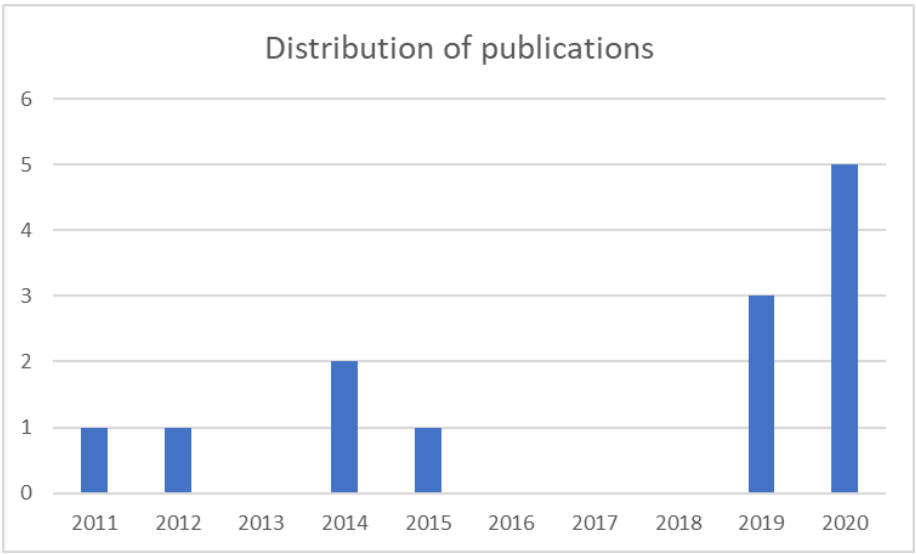

Figure 1. Annual distribution of publications.
Source: Authors, adapted from Ensslin et al. (2014).

Figure 2 shows the most cited authors from the final bibliographic portfolio (BP5).

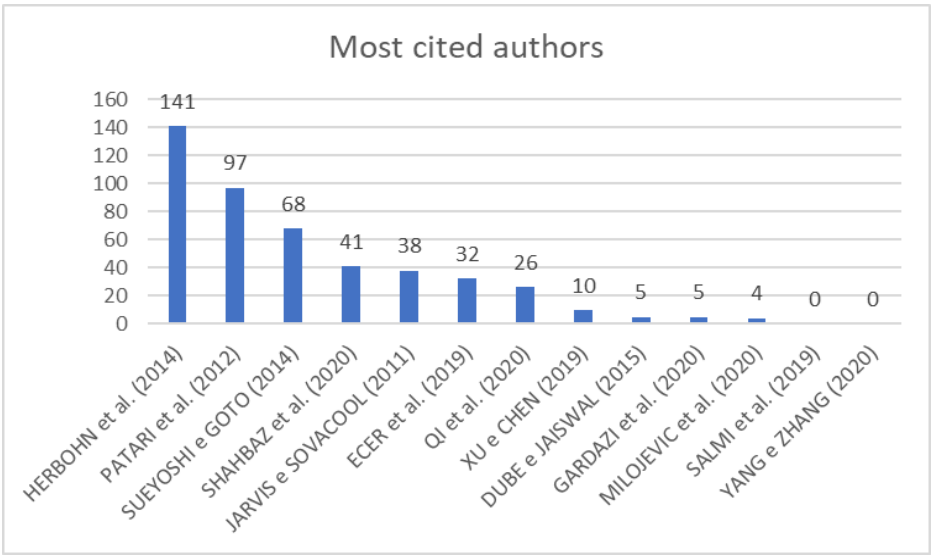

Figure 2. Most cited authors in the final bibliographic portfolio.
Source: Authors, adapted from Ensslin et al. (2014).

On Board 2, the thirteen studies from the final bibliographic portfolio can be found, with its respective main qualitative and quantitative CG aspects. It is important to observe the variation of research scope, because some studies choose a specific country, and others choose a specific object (i.e., board of directors, relationship with interested parties, regulatory governance, etc.).

Board 2. Sustainability and performance evaluation models.

Author(s)	Sustainability and performance evaluation model	Main CG aspects
Dube & Jaiswal (2015)	The study evaluates the ways of the corporate Governance mechanism on the energy sector in India, during the 2008-2012 period, regarding internal council, structure, corporate functioning strategies and financial performance.	• The following aspects are analysed: board of director size, number of board meetings, board of director present in these meetings, number of Executive Directors, number of non-executive managers, number of independent advisors, number of women directors, the existence of a remuneration committee, existence of an audit committee, internal audit mechanism and the existence of a risk assessment committee.
		• Other aspects that have been considered: diffusion of existing or desired competencies of the council, ongoing educational policy of the company, corporate governance code and its diffusion on the web, conformity letter from the CEO, program of infrastructure development of the local community, health, safety and environment management system, diffusion of climate change, annual reports on sustainability and adoption of UN's global pact.
		• There is a lack of adequate reports about risk management.
Ecer et al. (2019)	It assesses the sustainability performance of OPEC's countries and its consequences on the global sectors of energy. Using a Multiple Attribute Decision Making (MADM), Combined Compromise Solution (CoCoSo), the OPEC countries are analysed according to 41 sustainable development indicators, in 10 dimensions.	• The following governance indicators are evaluated (World Bank): corruption control, rule of law, political stability, voice and responsibility, and property rights.
Gardazi et al. (2020)	This study investigates in a critical manner the relation between the board of directors' attributes and the level of sustainability performance for the energy sector. Crucial attributes for the board of directors, such as being strongly associated with the compromise of reducing carbon footprint on the environment. It is proposed a conceptual structure that measures the influence of board of directors' attributes in companies regarding environmental and social sustainability performance. Furthermore, this article contributes to a body of knowledge about how the board of directors can perform a critical role in monitoring social and environmental threats.	• The good corporate governance must guide executives so they can work in favour of the interested parties' interests.
		• Agency Theory, Interested Parties Theory and Resource Dependence Theory are three underlying theories that can be used to explain the association between governance attributes and sustainability performance.
		• The Agency Theory says that the main role of leadership is to align the company's interests with the shareholder's interests. Therefore, the Agency Theory recommends a decision-making separation between executives and owners.
		• According to the theory of interested parties, the executives monitor corporate operations in the name of interested parties in order to meet the financial, ethical, social and moral needs of its shareholders. This way, good governance and sustainability allow balance to be reached in order to better manage the interested parties.
		• The theory of Resources Dependency's primary premise is the requirement for the environmental connection between the corporation and outside resources. Furthermore, the theory of Resources Dependency suggests that directors bring many resources, such as abilities, information, legitimacy, etc., as public policies decision makers, both clients and suppliers.
		• The figure of the independent director to balance the shareholder's and management's interests.
		• The diversity on the board of directors is a mix of qualities, attributes, demography and background experience of individual members of the council who may have an influence on the corporate environmental policy.
		• The balanced governance structure of the management council better controls the operations of the energy sector in order to mitigate risks related to the environment.
		• Diversity in the board of directors regarding gender, nationality, age and training background.
		• The need to integrate concepts from ISO 26000 and Global Compact to establish Corporate Social Responsibility practices in the oil, gas, and mining sector.

Board 2. Continued…

Author(s)	Sustainability and performance evaluation model	Main CG aspects
Herbohn et al. (2014)	It relates the dissemination of information about sustainability and performance as components of strategic management to deal with the interested parties' demands. An index of sustainability performance was developed, based on the International Finance Corporation's Measuring Sustainability Framework (2001). Using data from 339 mining and energy companies listed on Australia Securities Exchange in 2006, it is possible to conclude that the corporate sustainability performance is strongly associated with dissemination of information about sustainability, and for companies with a proactive communication strategy. Furthermore, the product's age and the company's size are both positively associated with sustainability.	• There are two compliance indicators that are used, according to the Australian Stock Exchange's Corporate Governance Principles, and an indicator that comes from a health and corporate security management system. • Alignment (%) with the Good Corporate Governance Principles and Best Practices. • The existence of a governance committee. • The ability to improve risk profile. • The skill to draw in human capital.
Jarvis & Sovacool (2011)	An integrative assessment combined with regulatory governance and metrics is proposed to evaluate the regulatory efficacy over the performance of water and energy service delivery. The study doesn't exempt sustainability and equity matters from the notions of regulatory efficacy. A highlight to the importance of mixed methods approach, that combine quantitative and qualitative metrics. The cause-and-effect relationship between governance, regulation and sector results is desired.	• The main elements to an efficient governance include not only ways to regulate, but also the consumer's necessities and preferences, market structures and a whole group of actors and institutions involved with the distribution of electricity and water. • The regulatory governance is essential to obtain an effective, efficient, fair and environmentally sustainable cost to the energy and water services provided. • Examples of regulatory governance attributes: clarity of the role and goals of a regulatory entity, autonomy, accountability (i.e., reporting to interested parties), transparency, participation, integrity, credibility, etc. • The use of 52 indicators to evaluate energy services and of 50 indicators for water distribution services.
Milojevic et al. (2020)	The main goal of this study is to assess the impact non-financial factors have in the financial audit of energy companies. In order to evaluate the audit's impact on the indicators' performance of these companies, it is suggested to use the integrated audit vector length method, as well as analysis of variance, having in mind sustainable development and the aspects of corporate social responsibility. This study was made based on data from five big energy companies (petroleum and gas) of different countries.	• The relevant governance instruments are the board of directors' size, level of management property and audit committee. • The use of Integrated Reports (IR) to disseminate financial and material information about the environmental, social and governance (ESG) performance. • Corporate communication stimulates the integrated thinking as the reports gather information on governance, performance and perspectives of the organizations.
Patari et al. (2012)	In this study, the sustainability matters are of special interest, and the financial performance of the companies is analysed under different perspectives. The data gathered comes from 2000, 2005 and 2009, for two groups of companies: the ones that are part of the Dow Jones Sustainability Indexes (DJSI) and the biggest ones from the global energy sector. The empirical analysis found evidence of a positive association between sustainable development and financial performance of the companies, especially when the performance's measure is based on market capitalization value.	• Good corporate governance in order to protect the shareholders' interests, good relationships with the interested parties protecting the interests of other interested parties, including the employees and local community's ones.

Board 2. Continued…

Author(s)	Sustainability and performance evaluation model	Main CG aspects
Qi et al. (2020)	The goal of this study is to define a group of criteria and dimensions for analysis of the governance-based strategy, for the sustainability of the energy and emerging economies industry. It stretches a hybrid decision model out, with intuitionistic fuzzy sets with interval values (IVIF, interval-valued intuitionistic fuzzy sets), defining the criteria and dimensions related to the strategic approach, based on corporate governance and supported by the literature. Assessment laboratories and test for decision making IVIF (DEMATEL) is built to measure the relative importance of criteria and dimensions. IVIF *VIseKriterijumska Optimizacija I Kompromisno Resenje* (VIKOR) is applied to rank performance based on the corporate governance of sustainable energy companies in emerging economies. Additionally, mass economies are intimately related to the ability of producing sustainably of the energy industry and having the best performance results for sustainable energy production based on corporate governance.	• Literature assumes that boards of directors are some of the most important governance mechanisms and that they have a significant role, independently of company size and the business sector. • Studies confirm that external and independent directors positively influence the creation of value, in terms of financial and non-financial results. • Necessity to combine sustainability and corporate governance in the energy sector. • Boards of directors act as catalysts for corporate governance and the protection of the interested parties' interests. • Dimensions that were considered to evaluate corporate governance, aiming to have a sustainable production: human capital (i.e., environmental experience), social capital (i.e., connections to universities) and cognitive ability (i.e., skills apprehension).
Salmi et al. (2019)	The Corporate Social Responsibility (CSR), that is, the corporate sustainability program is an activity that brings together the organization with the community, the environment, the workplace and the market. CSR, also known as "corporate citizenship", supports the organization aiming to improve the business' performance. CSR can be a model of self-regulated business that helps a company to be socially responsible, looking at the many perspectives, such as the organizations' own, interested parties' perspective and the audience's perspective. This study examines CSR's impact on the qualitative approach in the Malaysia's energy industry.	• Good relationships with interested parties based on engagement and dialogue is crucial, because it doesn't only affect the possibility of managing risks, but it also supports the development and lends the organization a competitive advantage. • Investments in CSR for the company's reputation management, to sustain profit and to establish moral obligation with society (ethical, sustainable, economic, environmental sustainability and social equality).
Shahbaz et al. (2020)	Provides empirical evidence about the association between council attributes, corporate social responsibility (CSR) and corporate performance in the global energy sector. The results indicate that council diligence and CSR committees are robust propellers of CSR development, according to the environmental, social and governance score, made alongside its three individual indicators. However, a higher CSR performance doesn't guarantee a higher financial performance, according to what's seen in the market and accounting's performances.	• The implementation of boards of directors with a bigger proportion of non-executive directors has a higher chance of being associated with a higher CSR performance (in other words, ESG and governance composite score). However, a bigger proportion of non-executive advisors is not a significant indicator of the environmental and social performance. • A bigger proportion of chairwomen in boards of directors also leads to a superior CSR performance, regarding the ESG composite score, as well as environmental and governance indicators. • Gender diverse boards, disciplined and focused on CSR that work in favour of interested parties and shareholders. • Proposition (policy makers) of suggestions to elevate the quality of boards of directors and strengthen their monitoring roles.

Board 2. Continued…

Author(s)	Sustainability and performance evaluation model	Main CG aspects
Sueyoshi & Goto (2014)	This study applies Data Envelopment Analysis (DEA) to examine sustainability for industrial sectors in Japan. Five measurements are included: UEN (Unified Efficiency under Natural Disposability), UEM (Unified Efficiency under Managerial Disposability), UENM (Unified Efficiency under Natural and Managerial Disposability), UEI (Unified Efficiency for Intermediate measurement) and UENM(DC) (Unified Efficiency under Natural and Managerial Disposability with Desirable Congestion). Among the five measurements, UEI examines the degree of how the company can reduce a number of undesirable products through technologic innovation or a change in management. The empirical results obtained from the offered approach identified two important implications: that the Japanese energy industry has been under government regulation for a very long time, in such a way that energy companies have no way to assess governance ability on the same level of other industries that are competing in a global market. The other implication is that technology aimed at innovation can improve in a more efficient way the energy sector's performance.	• Necessity of changes in corporate governance (for example, adding new board of directors' members with international experience or women who are executives, broadly found in the American and European energy industries). • The Japanese energy companies, specifically the electricity companies, don't have corporate governance resources under governmental regulation (lack of ability to increase corporate sustainability level). • Necessity of paying attention to consumers.
Xu & Chen (2019)	The study aims to find a moderator (debt funding) and employ a threshold effect model in order to explore the relationship between environmental management and financial sustainability in the energy industry. It uses the least squares dummy variable method in order to examine the relationship between environmental management, debt funding and financial sustainability; results show that environmental management and debt funding have a positive connection with financial sustainability. The mediator effect model and the limit effect model are employed to examine the relationship between environmental management, debt funding and financial sustainability; the results show that the debt funding can mediate the environmental management effects over financial sustainability, and there's a non-linear impact of the debt funding in financial sustainability for different environmental management limits.	• The debt's funding in general strengthens corporate governance and increases the company's market value and serves as a sign that reflects corporate performance. • Environmental management could improve a company's social reputation and financial performance. • The company must invest more in the environment in order to achieve long-term sustainable development. • Possible strategies: avoiding super exposition of environmental risks; and reducing intensive investments in carbon, transitioning to a low carbon economy (centred around creating long-term value).

Board 2. Continued…

Author(s)	Sustainability and performance evaluation model	Main CG aspects
Yang & Zhang (2020)	Assesses the green performance of new Chinese energy companies. A performance evaluation system was built that involves four social responsibility dimensions: liability management, responsibility tied to the market, security and environmental responsibility. After, this system was Applied in the analysis and evaluation of 18 energy companies' green performance in China with its social responsibility. Specific countermeasures were proposed to promote the health of energy companies and their sustainable development. These measures, to be implemented by energy companies, include the establishment and improvement of liability management systems, market support, strengthening of responsibility over security and diligent efforts to comply with its environmental responsibilities. Based on the application of a pre-established ranking and scores, out of the 18 energy companies researched, four were identified as winners.	• The dissemination of relevant information for the interested parties. • From the point of view of being responsible for security, energy companies have diligently carried out security training for its employees, and the mortality rate by accidents was kept at a below-average level. Most companies assigned great importance to security governance, which included investments to improve security and risks rectification, and dissemination of relevant security data. Less attention was given to the security system certification; bigger efforts to develop certified security systems are needed. • Certification of environmental management systems.

Source: Authors

Next, as a way to obtain a summary of the main researched CG aspects, such as audit committee, improvements on the risk profile, diversity in the board of directors, etc., a link between these aspects and the mining technique and text analysis by clustering was made (Han et al., 2012; Zhai & Massung, 2016) using a software for mining texts, KH Coder, version 3.Beta.01a (Higuchi, 2001) (parameters used: Method, Ward; Distance, Jaccard; Number of clusters, Auto), and the first part of the results are shown in Figure 3 (dendrogram or hierarchical clustering). The nine resulting clusters are delineated by rectangles, in "orange", that exist because of existing similarities between the elements (CG aspects) that make up each cluster. For example, on the second cluster, it is possible to view the corporate social responsibility practices associated with ISO 26000; and on the fifth cluster, it is shown that there is a similarity between "economic investment" and "risk certification".

Figure 4 shows another form of text analysis, through the map of word co-occurrence in relation to the word "committee" (Higuchi, 2001; Zhai & Massung, 2016) (parameters used: Subgraph modularity; Filter edges; Jaccard). Through the map, we can gather that, in the thirteen studies, there's a committee relationship with risk, management, board and audit; however, a sustainability committee reference is not found.

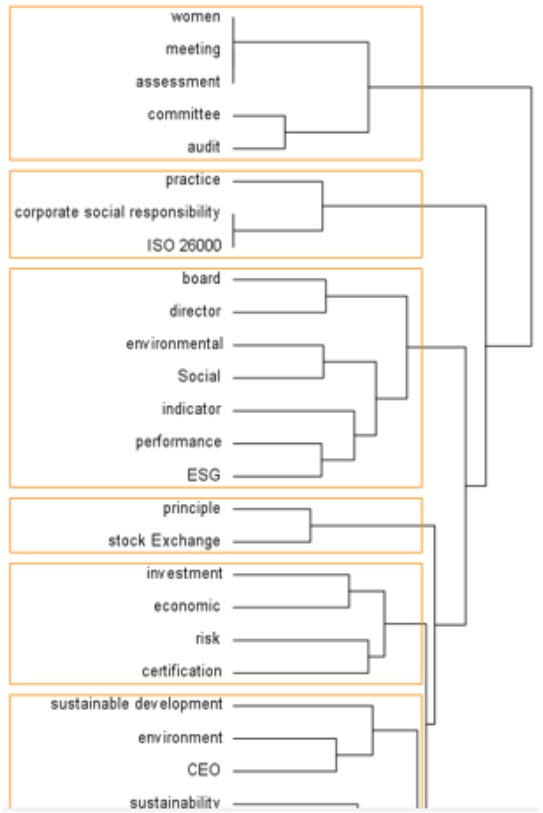

Figure 3. Summary of the CG aspects by hierarchical *clustering*;
Source: Authors, adapted from Higuchi (2001).

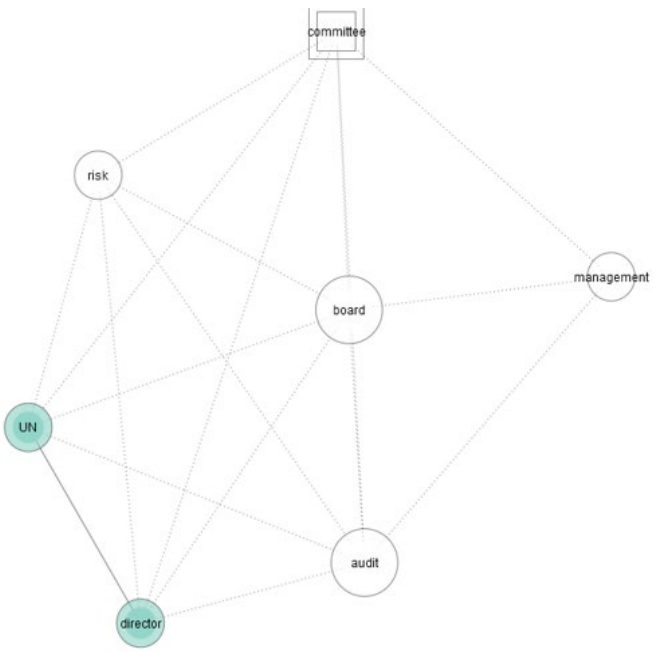

Figure 4. Map of word co-occurrence in relation to the “committee”;
Source: Authors, adapted from Higuchi (2001).

And, in order to conclude the systematic literature review of the 13 final bibliographic portfolio studies that talk about some corporate governance aspect, a relation of research keywords was used (i.e. ESG, World Bank, ISO 26000, UN, OECD, sustainability, sustainable development, performance, corporate governance, etc.) aiming to build a map of co-occurrence to show the relationships between studies/authors and keywords (parameters used: Variable/headings; authors; Filter edges; Jaccard; Top: 90). Figure 5, for example, shows that there's a single study, Ecer et al. (2019), that cites World Bank; environmental and risk are strongly related to many studies; and the absence of references to the OECD (Organization for Economic Cooperation and Development) and its corporate governance aspects.

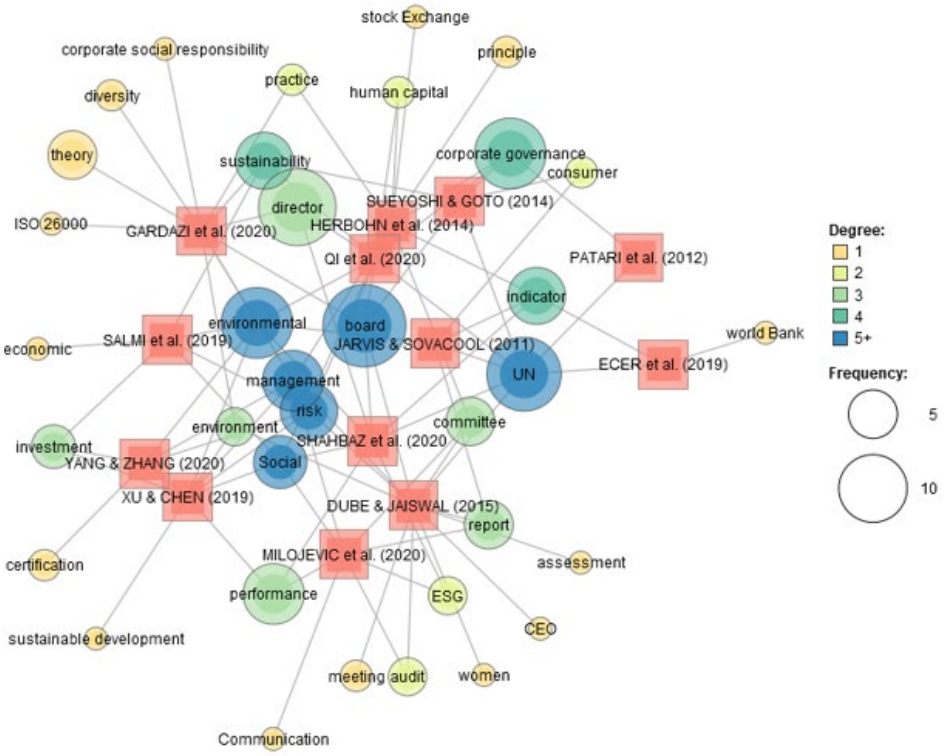

Figure 5. Co-occurrence map between studies/authors and research keywords;
Source: Authors, adapted from Higuchi (2001).

3 Other standards and studies

Next, it is analysed under the view of standards and other studies, significant aspects of CG:

a) GRI (*Global Reporting Initiative*) Standard for the electric sector (*Sustainability Reporting Guidelines & Electric Utility Sector Supplement*) (GRI, 2000) – according to Board 3:

Board 3. CG aspects for the electricity sector (GRI, 2000).

CG aspects
1 Organization's governance structure, including Committees under the highest governance body responsible for specific tasks, such as strategy setups or organizational supervision. The mandate's description and composition (including the number of independent members and/or non-executive members) of such committees and appoint any direct responsibility over economic, social and environmental performance matters.
2 Disclose if the president of the highest governance body is also an executive director; if the answer is yes, indicate their role inside the organization and the reasons why.
3 For organizations that have a unit council structure, disclose the number of members from the highest governance body that are independent and/or non-executive members.
State how the organization defines "independent" and "non-executive". This element applies only to organizations that have unit council structures.
4 Mechanisms so that shareholders and employees may give recommendations or orientations for the highest governance body. Include references to processes related to:
• The use of shareholders' resolutions or other mechanisms in order to allow the minority of shareholders to express their opinions to the highest governance body; and
• Notify and consult other employees about the workplace relationships with representative bodies, work council and highest governance body level.
The identification of topics related to economic, environmental and social performance aspects generated by mechanisms during the time frame covered by the report.
5 The connexion between remuneration for the members of the higher echelon of governance, senior and executive managers, and the organization's performance (including social and environmental performance).
6 Processes in force for the highest governance in order to ensure that conflicts of interest will be avoided.
7 Processes to determine the qualifications and backgrounds of members from the higher echelon of governance to guide the organization regarding the economic, environmental and social strategy.
8 Mission declarations developed internally or values, codes of conduct and relevant principles for the economic, environmental and social performance and its implementation status.
Explain to which degree these:
• Are applied through the entire organization in different areas and departments/units; and
• Relationship with internationally accepted standards.
9 Procedures from the highest governance body to supervise the organization: economic, environmental and social performance management, including relevant risks and opportunities, and adherence or conformity with internationally agreed standards, codes of conduct and principles. It includes the frequency with which the highest governance body evaluates the sustainability's performance.
10 Processes to evaluate the highest governance, particularly when it concerns the economic, environmental and social performance.

b) Study about corporate sustainability for organizations from the Brazilian energy sector (Pereira & Cândido, 2020): out of 59 studies, only 9 are about economic, social, environmental and corporate governance (CG) aspects (indicators). Out of a total of 113 suggested indicators, only 13 (9.8%) are related to CG – according to Board 4:

Board 4. CG aspects for the energy sector (Pereira & Cândido, 2020).

CG aspects
1 The issuing of preferred shares.
2 Preferred shareholders have the right to vote in relevant matters.
3 Dissemination mechanisms about the themes discussed during meetings.
4 Administrative procedures, arbitration proceedings or court lawsuits against the company, the managers or the controller, involving the unfair treatment of minority shareholders in the last five years.
5 Prohibition of loans and warranties in the controller, managers, and other related parties' favour.
6 The existence of an anonymous communications channel that is designated to receiving accusations, doubts and suggestions.
7 Accessible annual and/or sustainability report for people with disabilities.
8 Education projects about sustainability and the audiences reached by it.
9 Voluntary adherence to commitments related to sustainable development.
10 The existence of the sustainability committee.
11 Independent audit's advice.
12 Commitment to fighting corruption related to the internal audience.
13 Commitment to fighting corruption related to the company's partners.

c) Study about sustainability and performance for the American industrial sector, with the Triple Bottom Line (TBL) approach:

Hussain et al. (2018) in this study empirically investigate the relationship between corporate governance and sustainability performance under the view of the Triple Bottom Line model and the Agency Theory and Stakeholders Theory, of companies from 12 different economic sectors (technology and equipment, oil and gas, chemistry and pharmaceutical, food and drinks, financial, automobile, retail, domestic tools, industrial transportation, telecom, aerial, media) established in the United States. There were 100 *Global Fortune* 2013 north American companies of high performance considered and 152 sustainability reports using GRI standard, issued in the 2007 to 2011 period. The discoveries made support a new beginning in the theorizing process, in which theories must try not only to provide justification for the corporate governance's impact on Sustainability, but also to explain which sustainability dimension can be the most affected. Therefore, it is possible to conclude that, for example, the councils' independence positively impacts the environmental and social dimensions of sustainability; the CEO's duality negatively impacts the environmental dimension; and the sustainable committee's existence does not have a positive impact on the economic dimension of sustainability.

d) There is still, according to ISO 26000 (ABNT, 2010), initiatives and CG intersectoral tools suggested by international organizations:

- OECD (Organization of Economic Cooperation and Development): a tool for Risk Awareness for Multinational Companies in Weak Governance Areas;
- UNCTAD (United Nations Conference on Trade and Development): United Nations' Intergovernmental Work Group of Specialists in International Standards of Accounting and Reporting (ISAR);
- *AccountAbility*: associative organization open to all organizations and individuals, Series AA1000;
- Center for Business Ethics (ZfW): organization that seeks to promote business ethics in Germany and Europe: Values Management System;
- CSR360: Global Partners Network, promotes the international Exchange of information about CSR (Corporate Social Responsibility);
- EFQM (*European Foundation for Quality Management*): associative organization open to companies, governments and non-profit organizations: Structure for CSR and Excellence Model;
- *European Business Ethics Network* (EBEN): associative organization dedicated to promote corporate ethics;
- *Fair Labour Association* (FLA): multipartite initiative created to discuss work practices in supply chain;
- FORÉTICA: Norm SGE 21, Ethical Management System and CSR;
- *Global Reporting Initiative* (GRI): guidelines to prepare Sustainability Reports;
- *International Social and Environmental Accreditation and Labelling Alliance* (ISEAL): associative organization for organizations that establish the international socio-environmental norms;
- *The Natural Step International* (TNS): international non-profit organization dedicated to sustainable development;

- International Transparency (IT): associative global non-profit organization ONG that aims to fight corruption; has many tools;
- CSR *Europe Toolbox*: associative initiative, with tax charging, for european companies and CSR national organizations;
- Instituto Ethos: Brazilian organization that aims to promote social responsibility in the corporate sector; CSR Ethos indicators;
- International Chamber of Commerce (ICC): associative corporate global organization, with tax charging, established to represent the company's interests; has many tools and initiatives;
- *World Business Council for Sustainable Development* (WBCSD): associative organization aimed primarily at big corporations; many initiatives and tools;
- and, as an example of a specific initiative for the Energy sector: IHA, Organization of hydropower production companies: IHA's Sustainability Guidelines (recommendation of actions related to economic, social, and environmental matters).

e) Code for Corporate Governance Best Practices, a Brazilian Institute of Corporate Governance (IBGC) initiative, as a reference for governance best practices recommendations, aiming to contribute to the Evolution of corporate governance for companies and other organizations that are active in Brazil (IBGC, 2015).

f) Assessment of NBR ISO 14001 adherence, an Environmental Management Systems' norm, to the IBCG's Code of Corporate Governance Best in environmental audit reports, for ISO 14001 certified companies (Grotta et al., 2020).

g) Assessment of stakeholders' influences in determining the corporate governance directed at a Cleaner Production (P+L) (Oliveira et al., 2015).

It is necessary to recognize that there are a number of CG aspects that are considered by these standards and studies directed at the energy sector. However, some are frequently cited, such as: Board of Directors and council regarding gender diversity, training and knowledge of its members; how important is sustainability or sustainable development to a company, for example, the existence of a sustainability committee; independent audit; risk management and culture; etc. Therefore, the CG aspects of an organization should not be limited to a certain standard, study or practice.

4 Conclusions

The relation of studies in Board 2, with mention to CG and its qualitative or quantitative aspects, brings opportunities so that the companies can verify the level of alignment with national or international organizations (i.e., stock exchange, IBGC, UN, OECD, etc.) regarding principles, practices and corporate governance tools.

Since UN's 2030 Agenda established the 17 Sustainable Development Goals and its 169 global action targets, it consists in an opportunity for companies, governments, research institutions and civil society carry out integrated actions in order to reach these goals and targets.

Some studies cite ISO 26000 and the ESG concept (environmental, social, corporate governance). However, it is an opportunity to try and align the usual

corporate governance practices to the ones suggested by the UN (2030 Agenda) and by the OECD. For example, the use of indicators about the proportion of women in managerial positions and financial solidity, and the publishing of sustainability reports represents the practices aligned with the SDGs and UN's targets.

Moreover, in those studies the use of GRI standard for the electric sector isn't mentioned; complimentary, Pereira & Cândido (2020) show another thirteen CG aspects (Board 4). There is a gap about ISO 26000 regarding the application of initiatives and CG intersectoral tools suggested by international organizations, including ones for the energy sector. The same can be observed regarding OECD's standard for multinational companies. This standard establishes, for example, guidelines for the environment, anticorruption actions, consumer's interests, corporate governance principles and taxation matters.

In Brazil, ANEEL, through the Electric Sector Accounting Manual, mentions many other points about corporate governance that are suggested to the companies, such as: description of skills and performance evaluation of governance organs, roles in risk management and in the sustainability reports, corporate governance policies, etc. Therefore, a company having a well-structured governance and, thereafter, practising social responsibility, implies in a contribution to sustainable development, given its steadfast responsibility with society and the environment.

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Authors contribution

Ayrton Benedito Gaia do Couto worked on the conceptualization, theoretical-methodological approach, theoretical review, collection of studies, writing and final review of the manuscript. Luis Alberto Duncan Rangel worked on the writing and final revision of the manuscript.