Evaluation of environmental, social and economic-financial performance of companies listed on B3

Avaliação do desempenho ambiental, social e econômico-financeiro das empresas listadas na B3

Janine Patrícia Jost de Miranda Doutora em Ciências Contábeis e Administração. Universidade
0000-0001-7539-5770 Federal de Rondônia (UNIR) – Brasil. janine.jost@gmail.com.br.

Jéssica Taís Petri Mestrado em Ciências Contábeis. Universidade de Blumenau
0000-0002-0509-358X (FURB) – Brasil. jtpetri@furb.br

Adriana Kroenke Doutora em Métodos Numéricos em Engenharia. Universidade
0000-0001-6625-3017 de Blumenau (FURB) – Brasil. akroenje@furb.br

Ronaldo Leão de Miranda Doutor em Ciências Contábeis e Administração. Universidade
0000-0001-6778-2463 Federal de Rondônia (UNIR) – Brasil. ronaldo.miranda@unir.br

Nelson Hein Doutor em Engenharia de Produção. Universidade de
0000-0002-8350-9480 Blumenau (FURB) – Brasil. hein@furb.br

ABSTRACT

This study aimed to assess the environmental, social, and economic-financial performance of Brazilian companies listed on the B3 stock exchange through the application of game theory. It is based on the understanding that sustainable performance results from the integration of these three dimensions, considering that an organization's current actions should not compromise the ability of future generations to meet their own needs. Given the relevance of this topic, we analyzed a sample of 64 companies listed on the B3 stock exchange between 2010 and 2017, based on data obtained from the Thomson Reuters® database. For the analysis, performance rankings were developed using game theory in its scalar and vector approaches. The results revealed that companies with leading positions in the scalar rankings did not necessarily achieve the same prominence in the vector ranking. Vale S.A., Telefônica Brasil S.A., and CEMIG stood out in terms of aggregate sustainable performance; however, when the environmental, social, and economic-financial dimensions were examined separately, these companies did not maintain consistent performance across all of them. Therefore, this research advances previous studies by jointly analyzing multiple indicators to infer company performance and identify the different levels achieved in the groups of indicators that make up the sustainability tripod. In this sense, the study demonstrates, in practice, the application of a sustainable performance assessment tool that combines a holistic and individualized perspective, allowing us to identify in which dimensions—environmental, social, or economic-financial—organizations require greater improvement. Finally, the

article offers insights to investors and managers, highlighting the position of the companies analyzed and highlighting the tool's potential as an instrument for comparing organizational performance across different dimensions.
Keywords: company valuation; sustainable performance; game theory.

RESUMO

O presente estudo teve como objetivo avaliar o desempenho ambiental, social e econômico-financeiro das empresas brasileiras listadas na B3 com base na teoria dos jogos. Parte-se do entendimento de que o desempenho sustentável resulta da integração dessas três dimensões, considerando que as ações atuais de uma organização não devem comprometer a capacidade das gerações futuras de atender às suas próprias necessidades. Diante da relevância do tema, buscou-se analisar uma amostra de 64 companhias listadas na B3 entre 2010 e 2017, a partir de dados obtidos na base Thomson Reuters®. Para a análise, foram elaborados rankings de desempenho utilizando a teoria dos jogos em suas abordagens escalar e vetorial. Os resultados evidenciaram que as empresas com melhor posição nos rankings escalares não necessariamente obtiveram o mesmo destaque no ranking vetorial. As empresas Vale S.A., Telefônica Brasil S.A. e CEMIG se destacaram no desempenho sustentável agregado, entretanto, ao se examinar separadamente as dimensões ambiental, social e econômico-financeira, observou-se que não mantiveram o mesmo nível de desempenho em todas elas. Portanto, esta pesquisa avança em relação aos estudos anteriores ao analisar, de forma conjunta, múltiplos indicadores para inferir o desempenho das empresas e identificar os diferentes níveis alcançados nos grupos de indicadores que compõem o tripé da sustentabilidade. Nesse sentido, o estudo demonstra, na prática, a aplicação de uma ferramenta de avaliação do desempenho sustentável que combina uma perspectiva holística e individualizada, permitindo apontar em quais dimensões — ambiental, social ou econômico-financeira — as organizações necessitam de maior aprimoramento. Por fim, o artigo oferece subsídios a investidores e gestores, evidenciando a posição das empresas analisadas e destacando o potencial da ferramenta como instrumento de comparação do desempenho organizacional em diferentes dimensões.
Palavras-chave: avaliação de empresas; desempenho sustentável; teoria do jogo.

Recebido em 27/02/2024. Aprovado em 10/09/2025. Avaliado pelo sistema *double blind peer review*. Publicado conforme normas da APA.
https://doi.org/10.22279/navus.v16.1880

1 INTRODUCTION

In the organizational environment, companies only remain in the market if they are efficient. According to Porter and Kramer (2011), performance evaluation serves to quantify the efficiency and effectiveness of an organization's actions (Neely, Adams & Kennerley, 2002). Thus, the evaluation of the results achieved by the companies is carried out through performance indicators (Gomes, Kneipp, Kruglianskas, Rosa & Bichueti, 2014).

The evaluation of companies using performance indicators, as well as comparisons between them, has long been practiced (Bezerra & Corrar, 2006). However, according to these authors, indicator analysis is usually conducted individually, that is, indicators are analyzed independently and according to the organization’s needs, which does not allow for assessing the influence on one another or identifying the most relevant indicator.

It is noticed that the analysis of the organizations’ performance affects their competitiveness in the current market. New demands and restrictions have emerged and aspects such as sustainability, environmental protection, and social well-being are now considered as important as economic growth (Gomes *et al.*, 2014). These aspects have gained prominence in organizational evaluation due to the emergence and growth of national and international initiatives addressing social and environmental issues (Porter & Kramer, 2011).

In terms of sustainability, there are two points of view that can be considered. On the one hand, the imposition of sustainable actions for companies is seen as an impediment to performance at its cost, and on the other hand, it is seen as a stimulus to innovation and a source of competitive opportunity (Porter & Van der Linde, 1995). In the research by Cecon, Hein and Kroenke (2018), it was found that the competitive advantage of companies increases when they voluntarily disclose their sustainable actions, as companies with greater environmental transparency exhibited higher market values.

However, research has offered contradictory results on the relationship between sustainability and the financial performance of organizations (Magon, Thomé, Ferrer & Scavarda, 2018). Research also highlights a lack of understanding regarding sustainability, which hinders the development of tools for modeling sustainable businesses (Bell & Morse, 2005; Dossa & Kaeufer, 2014). Thus, the vision of sustainability is a continuous process, in which the organization must adapt and renew itself (Diegues, 1992).

Related to sustainability and company valuation, the study by Kroenke, Caballero, Cecon and Hein (2018) stands out, which sought to highlight the scalar and vector games in the evaluation of social and environmental

disclosure and their relationship with market value. The research by Nascimento, Kroenke and Marcos (2016) showed the effect of participation in the Corporate Sustainability Index (ISE) on the economic and financial performance of companies in the transport sector. These studies attest to the importance of sustainability for entities under different approaches.

It is also worth mentioning that the use of quantitative information related to sustainability, as carried out in this article, is still rarely used (Stoycheva et al., 2018). This quantitative analysis of sustainability facilitates inter-organizational comparability. As noted by Boiral and Henri (2017), it is difficult to compare sustainable performance between companies when analyzing sustainability reports with qualitative data. Not all companies follow disclosure standards, and in most cases, the information provided is incomplete.

Based on the foregoing, the research question that directs this investigation emerges: What is the sustainability ranking of Brazilian companies listed in B3? In order to answer this question, the objective of this research is to evaluate the environmental, social and economic-financial performance of Brazilian companies based on game theory. In this way, the sustainable performance of companies listed on B3 will be assessed in the period from 2010 to 2017.

Based on previous studies, game theory can be applied in this evaluation, as, according to Fiani (2009), it analyzes decision making among agents who interact in competitive situations, including their ability to influence one another. Contextualizing this statement for the present study, it can be said that in the analysis of companies' performance, each indicator has the potential to affect the classification of organizations.

This research is justified by the number of studies on this topic, which present controversial results, indicating a gap and enabling new discussions and investigations. Additionally, economic and financial performance is indispensable for organizations and is expected to boost social and environmental performance. According to Nossa, Rodrigues and Nossa (2017), there are many articles that analyze the relationship between sustainability indicators and economic-financial indicators with controversial results, indicating that the theme deserves deeper analysis. Moreover, the focus on quantitative indicators should be highlighted, as Stoycheva et al. (2018), note that most research on sustainability relies on qualitative indicators.

In this perspective, it is expected to contribute theoretically to research on the list of environmental, social and economic-financial indicators, further encouraging the discussion on sustainability in companies. On practical issues, this article seeks to contribute to both

investors and business managers, highlighting the positions of the analyzed companies and demonstrating the potential of this tool to compare their performance with other organizations across multiple dimensions.

2 LITERATURE REVIEW

This topic presents the theoretical discussion of the themes that support this research. In this way, the performance analysis of companies is approached and then, this analysis will be funneled towards sustainable performance.

2.1 Performance analysis of companies

Companies differ from each other in several ways: history, organization, location, people, products, size, and these differences interfere with their performance (Brito & Vasconcelos, 2005). The performance analysis of organizations has the function of helping the company to verify its situation in relation to the other organizations belonging to the market (sector) in which it is inserted (Callado, Callado & Almeida, 2008; Cruz, 2017). According to the study by Boff, Procianoy and Hoppen (2006), with the performance analysis, the analysts have the possibility to predict the performance of the organizations, that is, based on the information disclosed by companies, analysts can project how these organizations are likely to perform in the future.

The analysis of companies' performance is not a recent practice and it is usually done through the data contained in the financial statements, which represent the current situation of the company, being a source of innumerable information to the managers, which helps in more efficient analyses in the decision-making process(Bortoluzzi, Ensslin & Ensslin, 2011).

However, it can be said that the evaluation of the companies' performance compiles the financial statements into indicators (Camargos & Barbosa, 2005). Therefore, the analysis process of these indicators is beneficial for organizations, as it provides managers with the necessary information to assess the results of adopted strategies and evaluate management performance itself (Ittner & Larker, 1998). Thus, performance indicators are fundamental for measuring organizational performance (Callado, Callado & Almeida, 2008).

Regarding sustainable development, its concept is parallel and compatible with economic development and environmental protection (Chen, Yu & Hu, 2018). According to the IAEA (2005), sustainable development is an economic policy that aims to guide society toward the proper implementation

of measures that ensure environmental protection and benefit investors and consumers.

Furthermore, the analysis of sustainable performance in organizations is still considered a challenge, due to the vague concept of sustainability indicators (Li & Mathiyazhagan, 2018; Jiang, Liu, Liu, Li, Cong, Zhang & Shi, 2018). Another difficulty lies in the absence of a universal standard for analyzing the Triple Bottom Line (TBL) or for each of its components. This is because the TBL is a dynamic concept that can be adapted according to the country, sector, and company, with no clear guidelines on how to implement the measures required to achieve sustainability objectives (Aris, Marzuki, Othman, Rahman & Ismail, 2018).

Based on this, the performance analysis of companies, in addition to considering economic-financial and profitability aspects, must also consider environmental and social aspects, including resulting in sustainability analyses, as reported by Gomes *et al*. (2014). These sustainable aspects will be further discussed below.

2.2 Sustainable Performance

The term sustainability and sustainable performance arose from the concern about the impacts of production and human actions on the environment, as expressed in the report of the World Commission on Environment and Development (WCED, 1987). This report defines sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, 1987).

However, the number of companies adopting sustainability strategies, initiatives, and the disclosures of environmental and social activities has increased, causing changes in business models (Xie, Nozawa, Yagi, Fujii & Managi, 2019). Thus, sustainable development seeks to meet the economic progress of organizations while also addressing socio-cultural interests and protecting the environment (Aris *et al*., 2018).

Among the various definitions of sustainable development found in the literature, the one that was most widespread was the definition by Elkington and Burke (1989), which states thatsustainable development involves the simultaneous search for economic prosperity, environmental quality and social equity. This definition became known as the Triple Bottom Line (TBL), or the Sustainability Tripod, and argues that sustainable development must consider these three dimensions: environmental, social and economic-financial.

Thus, according to Brundtland (1987), environmental sustainability is the maintenance of the quality of air, land, water and living beings. The social dimension of sustainability, on the other hand, is related to issues

of social equity and the improvement of the quality of life of society in general, encompassing employees, the community, consumers and suppliers (CALLADO, 2010). Finally, sustainability related to finance, refers to the growth of book value of balanced equity, with the growth of its assets and revenues and liabilities (Gómez-Bezares, Przychodzen & Przychodzen, 2017).

The environmental dimension aims to keep ecosystems alive and diverse. The social dimension suggests that organizations should encourage education, culture, leisure and social justice to the community, while the economic-financial dimension emphasizes that companies must remain profitable and generate income value (Vellani & Ribeiro, 2009). Thus, Elkington and Burke (1989) argue that companies may not be able to keep their customers, employees, or other Triple Bottom Line stakeholders indefinitely, however, the greater the loyalty, mutual respect and benefits, the higher the likelihood that the organization will be sustainable.

Regarding sustainability, the study by Kroenke, Caballero, Cecon and Hein (2018) highlights the relevance of companies operating in sectors with high environmental impact. These involve information about their employees, the community in general, the environment in which they operate, the use of natural resources and the way in which they protect the environment. Based on this, the authors recommend that organizations with a high environmental impact seek to enhance their market value, noting that greater disclosure is associated with higher market valuation.

According to another research related to sustainability, the findings indicate that sustainable practices maintained over a long period, result in an increase in economic and financial gains for companies (Nascimento, Kroenke & Marcos, 2016). In the research by Cecon, Hein and Kroenke (2018), the association between environmental disclosure and the market value of Brazilian companies is analyzed. The results showed that the company's position improves with the disclosure of the Annual or Sustainability Reports with greater quality of information. Thus, the importance of timely disclosure is highlighted, covering a greater number of subcategories, in order to improve their assessment and, consequently, competitiveness in the market (Cecon, Hein & Kroenke, 2018).

The various definitions of sustainable development, the definition of methods and metrics to assess the sustainable performance of organizations are also considered a challenge for institutions (Hay & Noonan, 2005). In this sense, several studies have been dedicated to evaluating the existing indicators and to developing new quantitative indicators that are more easily measurable (Costanza, Daly, Fioramonti, Giovannini, Kubiszewski, Mortensen, ...& Wilkinson, 2016; Engebretsen, Heggen & Ottersen, 2017; Nossa, Rodrigues & Nossa, 2017).

3 METHODOLOGY

This research aims to evaluate the environmental, social and economic-financial performance of Brazilian companies based on game theory. This analysis had as population the companies listed in B3, in the period from 2010 to 2017. Since not all companies provided the necessary information for the research, the sample was reduced to those companies that presented the necessary information for the analysis.

Starting from the defined population, organizations that did not disclose information on environmental, social and economic-financial indicators were excluded. In a second step, financial organizations were excluded, as they have peculiar accounting characteristics, and those companies that presented negative equity were also excluded, in order not to bias the results of the economic-financial indicators. Thus, the research sample included 64 companies listed in B3, as shown in Table 1.

Table 1
Research Sample

Description	Companies
Population	490
(-) Did not present information in the environmental and social indicators	407
(-) Financial	13
(-) Negative PL	6
(=) Sample	64

Source: Research Data.

Even starting from a comprehensive population, that is, all companies listed on the Brazilian stock exchange, Brazil Bolsa Balcão (B3), the sample of this study was quite reduced, as most companies were excluded from the analysis because they did not present data regarding the focus of this research (environmental and social). When analyzing the sector of the analyzed sample, it is noticed that most of the companies belong to the manufacturing sector (32.8%), services and public utility (21.8%) and retail trade (9.37%), as can be seen in Table 2, shown below.

Table 2
Description of the Sectors of the Companies in the Sample

Sector	Companies	% Sample
Agriculture, forestry, fishing and hunting	1	1,56%
Construction	5	7,81%
Educational Services	2	3,12%
Health and social assistance	2	3,12%
Information	2	3,12%
Manufacturing	21	32,81%
Mining, quarrying and oil and gas extraction	2	3,12%

Professional, scientific and technical services	1	1,56%
Real estate and rent and leasing	4	6,25%
Retail trade	6	9,37%
Transportation and Warehousing	3	4,68
Utilities	14	21,87
Wholesale Trade	1	1,56%
Total	64	100%

Source: Research Data.

In this study, environmental, social and economic-financial indicators were examined to analyze the sustainable performance of the sampled organizations. These indicators were obtained from the Thomson Reuters® database, and Table 3 presents a summary of what each of the environmental and social indicator represents.

Table 3
Environmental and social variables

Variables	Description
Environmental	
Resource Use	They reflect the ability of an organization to reduce the use of materials, energy or water, by finding efficient solutions.
Emissions	Measures the company's commitment and effectiveness in reducing environmental emissions in production and operational processes.
Innovation	The organization's ability to reduce costs and environmental charges for its customers, creating opportunities through new technologies, environmental processes and eco-designed products.
Social	
Workforce	The company's effectiveness for job satisfaction, providing a healthy and safe workplace, with diversity and equal development opportunities for its employees.
Human rights	The organization's ability to respect fundamental human rights conventions.
Community	The company's commitment to be a good citizen, which protects public health and respects business ethics.
Product Responsibility	The company's ability to produce quality products and services with the safety, integrity and privacy of its customers.

Source: Adapted from Thomson Reuters®.

Table 4 provides a summary of the economic and financial indicators used in this analysis. These indicators were obtained from the Thomson Reuters® database.

Table 4
Economic and financial variabless

Variable	*Próxy*	Authors
Return on Total Assets (ROA)	ROA = EBIT / total assets	Tan and Peng (2003); Daniel and Astruc (2004); Laffranchini and Braun (2014).

Returno n Equity (ROE)	ROE = net profit / net worth	Tan and Peng (2003); Daniel and Astruc (2004); Laffranchini and Braun (2014).
General Liquidity (LG)	LG = (current assets + non-current assets) / (current liabilities + non-current liabilities)	Bezerra and Corrar (2006); Schuhmann (2008); McLean (1997); Morel, Santos, Francisco and Paranaiba (2019).
General Indebtedness (EG)	EG = (current liabilities + non-current liabilities) / (current assets + non-current assets)	Bezerra and Corrar (2006); Gapenski and Pink (2007); Silva, Rodrigues, Sousa, Nascimento and Vieira (2019).

Source: Research Data.

After data collection, this information was tabulated with the aid of Microsoft Excel. Initially, the data were normalized, considering $f_{ij} = \frac{i_j - i_j^-}{i_j^+ - i_j^-}$ for indicators of the type "the bigger, the better" and $f_{ij} = 1 - \left(\frac{i_j - i_j^-}{i_j^+ - i_j^-}\right)$ for indicators whose interpretation is "the smaller the better".

After data normalization, the rankings were elaborated. The first ranking was based on environmental indicators, the second ranking considered social information, the third ranking considered economic-financial information and the fourth ranking analyzed the set of these indicators (environmental, social and economic-financial) in order to verify sustainable performance organizations.

These rankings were developed using game theory models, solved through linear programming problems. According to Gomes, Silva and Parré (2017), this technique models the strategic behavior between two or more players (agents, which in this study are companies) and determines the strategy adopted that ensures the best result of the game, among the behavior and actions of opponents.

For the environmental ranking, a scalar game was applied, in which the first three restrictions refer to the three environmental variables (resource use, emissions and innovation). The fourth constraint ensures that the sum of strategies equals 100%, and the final constraint enforces non-negativity.

$$Max\ Z = v_1$$

$$S_a \qquad a_{1,1}e_1 + a_{2,1}e_2 + \ldots + a_{64,1}e_{64} \geq v1$$

$$a_{1,2}e_1 + a_{2,2}e_2 + \ldots + a_{64,2}e_{64} \geq v1$$

$$a_{1,3}e_1 + a_{2,3}e_2 + \ldots + a_{64,3}e_{64} \geq v1$$

$$e_1 + e_2 + \cdots + e_{64} = 1$$

$$e_1 + e_2 + e_3 + \cdots + e_{64} \geq 0$$

For the social ranking, a scalar game was also applied, where the first four restrictions refer to the four social variables (workforce, human rights, community and product responsibility). The fifth restriction refers to the sum of strategies that must add 100% and the last constraint represents non-negativity.

$$Max\ Z = v_2$$
$$\begin{aligned} S_a \quad & a_{1,1}e_1 + a_{2,1}e_2 + \ldots + a_{64,1}e_{64} \geq v_2 \\ & a_{1,2}e_1 + a_{2,2}e_2 + \ldots + a_{64,2}e_{64} \geq v_2 \\ & a_{1,3}e_1 + a_{2,3}e_2 + \ldots + a_{64,3}e_{64} \geq v_2 \\ & a_{1,4}e_1 + a_{2,4}e_2 + \ldots + a_{64,4}e_{64} \geq v_2 \\ & e_1 + e_2 + \cdots + e_{64} = 1 \\ & e_1 + e_2 + e_3 + \cdots + e_{64} \geq 0 \end{aligned}$$

Similarly, for the economic-financial ranking, a scalar game was applied, where the first four restrictions refer to the four economic-financial variables (ROA, ROE, LG and EG). The fifth constraint refers to the sum of strategies which must add up to 100% and the last constraint represents non-negativity.

$$Max\ Z = v_3$$
$$\begin{aligned} S_a \quad & a_{1,1}e_1 + a_{2,1}e_2 + \ldots + a_{64,1}e_{64} \geq v_3 \\ & a_{1,2}e_1 + a_{2,2}e_2 + \ldots + a_{64,2}e_{64} \geq v_3 \\ & a_{1,3}e_1 + a_{2,3}e_2 + \ldots + a_{64,3}e_{64} \geq v_3 \\ & a_{1,4}e_1 + a_{2,4}e_2 + \ldots + a_{64,4}e_{64} \geq v_3 \\ & e_1 + e_2 + \cdots + e_{64} = 1 \\ & e_1 + e_2 + e_3 + \cdots + e_{64} \geq 0 \end{aligned}$$

For the sustainable ranking, encompassing the three dimensions analyzed, environmental, social and economic-financial indicators, a vector game was applied. In this linear programming problem, the three dimensions are analyzed in a single model, enabling the analysis in general. Thus, the first three restrictions refer to environmental variables, the next four restrictions refer to social variables and, subsequently, the four restrictions refer to economic and financial variables. The 12th constraint

refers to the sum of strategies that must add up to 100% and the last constraint (13th) represents non-negativity.

$$Max\ Z = v_1 + v_2 + v_3$$

$$\begin{aligned}
S_a \quad & a_{1,1}e_1 + a_{2,1}e_2 + \ldots + a_{64,1}e_{64} \geq v_1 \\
& a_{1,2}e_1 + a_{2,2}e_2 + \ldots + a_{64,2}e_{64} \geq v_1 \\
& a_{1,3}e_1 + a_{2,3}e_2 + \ldots + a_{64,3}e_{64} \geq v_1 \\
& a_{1,1}e_1 + a_{2,1}e_2 + \ldots + a_{64,1}e_{64} \geq v_2 \\
& a_{1,2}e_1 + a_{2,2}e_2 + \ldots + a_{64,2}e_{64} \geq v_2 \\
& a_{1,3}e_1 + a_{2,3}e_2 + \ldots + a_{64,3}e_{64} \geq v_2 \\
& a_{1,4}e_1 + a_{2,4}e_2 + \ldots + a_{64,4}e_{64} \geq v_2 \\
& a_{1,1}e_1 + a_{2,1}e_2 + \ldots + a_{64,1}e_{64} \geq v_3 \\
& a_{1,2}e_1 + a_{2,2}e_2 + \ldots + a_{64,2}e_{64} \geq v_3 \\
& a_{1,3}e_1 + a_{2,3}e_2 + \ldots + a_{64,3}e_{64} \geq v_3 \\
& a_{1,4}e_1 + a_{2,4}e_2 + \ldots + a_{64,4}e_{64} \geq v_3 \\
& e_1 + e_2 + \cdots + e_{64} = 1 \\
& e_1 + e_2 + e_3 + \cdots + e_{64} \geq 0
\end{aligned}$$

By solving these problems, using the Excel Solver tool, we obtain the optimal strategies for each game. Thus, the results of the problem may present pure strategies $e_i = 1$ or mixed strategies $(\sum_{i=1}^{n} e_i = 1)$.

Thus, in the analyzed games, the strategies resulting from the application of the model were considered. Specifically, when the application resulted in pure strategy, the best company was removed from the model, whereas when a mixed strategy was obtained, all companies were retained in the analysis.

4 RESULTS AND DISCUSSION

The analysis and discussion of the results begin with the presentation of the developed rankings. At first, the rankings were developed to individually analyze the environmental, social and economic-financial aspects. Subsequently, these three dimensions were analyzed in general in a single model to form the ranking of sustainability, since according to Elkington and Burke (1989), sustainability encompasses environmental, social and economic-financial issues.

Table 5 presents the results of applying the scalar model to the environmental indicators, showing the ten best positioned companies for 2017, as described in the methodology.

Table 5
Ranking of the environmental performance of companies in 2017

Companies	Position	Value	Z	Strategy
EDP Energias do Brasil SA	1ª	$x_{40} = 0{,}480$	0,829	Mixed
Companhia Energética de Minas Gerais CEMIG	2ª	$x_{6} = 0{,}382$	0,829	Mixed
Tim Participações SA	3ª	$x_{29} = 0{,}138$	0,829	Mixed
Lojas Renner SA	4ª	$x_{4} = 0{,}501$	0,806	Mixed
Ecorodovias Infraestrutura e Logística SA	5ª	$x_{61} = 0{,}499$	0,806	Mixed
Engie Brasil Energia SA	6ª	$x_{15} = 0{,}543$	0,798	Mixed
Klabin SA	7ª	$x_{34} = 0{,}391$	0,798	Mixed
Companhia Siderúrgica Nacional	8ª	$x_{2} = 0{,}066$	0,798	Mixed
Centrais Elétricas Brasileiras SA	9ª	$x_{25} = 0{,}597$	0,791	Mixed
Ultrapar Participações SA	10ª	$x_{31} = 0{,}403$	0,791	Mixed

Source: Research Data.

Table 5 presents only the first ten companies classified in relation to their environmental performance in 2017 due to the number of companies analyzed, highlighting the companies with the best performances. It should be noted that until the tenth position, the application of the model resulted in mixed strategies, so that in each round more than one company was indicated, most of which were withdrawn from 3 companies per game. For this game 32 rounds were applied.

The first round resulted in the classification of the companies EDP Energias do Brasil SA, CEMIG and TIM as the best companies in relation to environmental performance in 2017. Subsequently, after their removal from the game, subsequent rounds ranked Rener and Ecorodovias in the following positions. The game continued until the the last company, Fibria Celulose SA, was classified.

The same model was applied to the other years analyzed and to the other groups of indicators verified so that an environmental ranking, a social ranking, an economic-financial ranking and a sustainability ranking for each year were obtained, totaling 32 rankings.

Table 6
Ranking of Environmental Performance

Companies	2010	2011	2012	2013	2014	2015	2016	2017	Run Points	RG
Vale AS	1°	1°	1°	3°	1°	4°	9°	15°	477	1°
CEMIG	7°	7°	11°	1°	4°	3°	1°	2°	476	2°
Ecorodovias SA	4°	2°	3°	4°	6°	15°	14°	5°	459	3°

Tim Participações SA	2°	4°	6°	10°	10°	8°	12°	3°	457	4°
CCR as	3°	3°	2°	8°	7°	7°	3°	37°	442	5°
Natura Cosméticos SA	6°	18°	8°	5°	13°	13°	5°	11°	433	6°
Even Constr. e Incorp.SA	9°	9°	7°	13°	9°	9°	10°	23°	423	7°
Cia Brasileira de Distrib.	31°	31°	5°	7°	16°	2°	8°	13°	399	8°
Engie Brasil Energia as	33°	24°	35°	9°	2°	1°	6°	6°	396	9°
Cia Paranaense de Energia	13°	20°	18°	6°	8°	23°	11°	21°	392	10°

Source: Research Data.

Based on Table 6, it is possible to analyze the classification of companies in relation to their environmental performance annually, as well as a general ranking of the environmental performance of these companies in the analyzed period. Vale SA was the highest-ranked company in the general ranking. This was due to the fact that it had a good classification in the years 2010, 2011, 2012 and 2014. However, its ranking declined from 2015, reaching fifteenth place in 2017, which may serve as a signal for the company to improve its management practices.

CCR SA is also notable, as it ranked 37th in 2017; however, due to its strong performance in 2010, 2011, 2012, and 2016, it was ranked fifth overall for the period. Engie Brasil Energia SA exhibited a similar pattern, ranking 35th in 2012, but achieving first place in 2015, which secured its ninth position in the overall environmental ranking.

Thus, even with these companies showing a prominent position in the period, the decline in performance may indicate to managers the need to adapt strategies and policies. Following analyzing of environmental performance, the same procedures were applied to evaluate social, economic-financial and sustainable performance. Table 7 presents the ranking of the social performance of the companies analyzed annually and the general ranking (RG) for the period based on accumulated points.

Table 7
Ranking of Social Performance

Companies	2010	2011	2012	2013	2014	2015	2016	2017	Run Points	RG
Eletropaulo SA	1°	1°	1°	4°	1°	1°	1°	1°	501	1°
Vale SA	9°	3°	2°	1°	2°	2°	3°	8°	482	2°
Petróleo Brasil SA Petrobras	2°	2°	9°	2°	4°	8°	4°	10°	471	3°
EDP Energias do Brasil SA	11°	6°	6°	3°	3°	3°	6°	4°	470	4°
Fibria Celulose SA	6°	14°	10°	7°	9°	7°	19°	2°	438	5°
CPFL Energia SA	3°	19°	28°	6°	5°	13°	14°	7°	417	6°
Duratex SA	7°	17°	16°	21°	7°	17°	10°	6°	411	7°
Gafisa SA	8°	11°	12°	16°	10°	19°	12°	14°	410	8°
MRV SA	5°	43°	34°	5°	6°	4°	2°	3°	410	9°

Cosan SA	14°	9°	8°	26°	8°	5°	18°	23°	401	10°

Source: Research Data.

When analyzing the position of companies in relation to social performance, it can be seen that they have behaved differently from what happened in their environmental indicators. The ranking of social performance is led by Eletropaulo SA, which occupied the first position in most years and only in 2013 was in the fourth position. The other companies in the top ten for social performance are not the same as those ranked in the top ten for environmental performance.

However, Vale SA, for example, dropped from the first position in the environmental ranking to the second position in the social ranking. When analyzing 2017 specifically, its social performance was better rated higher than its environmental performance, ranking eighth in social indicators compared to fifteenth in environmental indicators. Thus, although Vale achieved stronger overall environmental performance, its social performance in the final year was better classified. It is also interesting to note that MRV SA occupied 43rd position in 2011 and 34th position in 2012, but even so, in the general social ranking it was in ninth place.

Next, the ranking of the economic and financial performance of the companies in the sample was developed, the result of which is shown in Table 8 following the same procedures previously explained.

Table 8
Ranking of Economic-Financial Performance

Companies	2010	2011	2012	2013	2014	2015	2016	2017	Run Points	RG
M Dias Branco SA	6°	3°	4°	1°	3°	6°	4°	1°	484	1°
Odontoprev SA	4°	2°	6°	6°	4°	3°	3°	2°	482	2°
Cia Hering	15°	1°	3°	2°	1°	1°	8°	4°	477	3°
Petro Rio SA	1°	19°	1°	3°	22°	4°	1°	11°	450	4°
CTEEP	9°	9°	10°	5°	10°	10°	2°	10°	447	5°
Estacio Participacoes SA	8°	20°	15°	4°	7°	12°	11°	7°	428	6°
Kroton Educacional SA	5°	39°	11°	8°	6°	8°	6°	6°	423	7°
Ambev SA	17°	6°	38°	9°	5°	7°	7°	3°	420	8°
Raia Drogasil SA	10°	7°	5°	7°	12°	17°	13°	23°	418	9°
Telefonica Brasil SA	14°	8°	8°	10°	19°	13°	14°	9°	417	10°

Source: Research Data.

Analyzing the results of this model, it is evidentthat the companies ranked in the top ten positions in relation to economic and financial performance are not the same listed among the ten best classified in relation to environmental performance or in relation to social performance. The company M Dias Branco SA stood out in the first position in the general economic-financial ranking, followed by Odontoprev SA. Cia Hering, despite achieving

first place in 2011, 2014, and 2015, ranked third overall due to fluctuations in other years.

Through these partial analyzes (environmental, social and economic-financial), it appears that companies have different performance in relation to each group of indicators. These results can be analyzed by managers in order to adapt strategies in order to maintain or improve the performance of companies.

Based on this observation, and in order to assess the sustainable performance of the companies analysed, the vector model and the ranking of sustainable performance presented in Table 9 were elaborated.

Table 9
Sustainability Performance Ranking

Companies	2010	2011	2012	2013	2014	2015	2016	2017	Run Points	RG
Vale AS	2°	2°	1°	3°	1°	1°	4°	6°	492	1°
Telefônica Brasil SA	39°	6°	5°	2°	4°	4°	6°	4°	442	2°
CEMIG	5°	5°	14°	10°	6°	14°	7°	17°	434	3°
Duratex SA	12°	21°	11°	4°	7°	6°	10°	12°	429	4°
Tim Participações SA	11°	15°	6°	8°	12°	10°	28°	5°	417	5°
Gafisa SA	9°	14°	2°	6°	5°	13°	22°	25°	416	6°
Multiplan SA	13°	28°	34°	1°	2°	2°	81°	9°	415	7°
EDP Energias do Brasil SA	14°	35°	20°	21°	11°	18°	1°	2°	390	8°
Engie Brasil Energia SA	31°	12°	22°	7°	27°	8°	3°	19°	383	9°
CCR SA	4°	4°	10°	20°	24°	16°	12°	42°	380	10°

Source: Research Data.

Most of the companies ranked in the top ten for sustainable performance already had prominent positions in the previous rankings, except Multiplan SA, which was not among the 10 best classified in any of the individual rankings (environmental, social or economic-financial). The first ranked company in the sustainable performance ranking is Vale SA, which had already been classified as the best company in relation to environmental performance and as the second best company in relation to social performance. Vale SA ranked first in relation to sustainable performance in 2012, 2014 and 2015, and second in the years 2010 and 2011, which ensured its classification as the best company in relation to sustainable performance.

The other two companies that stood out in the sustainable ranking were Telefônica Brasil SA and CEMIG. The second best position was for Telefônica Brasil SA, having previously appeared only in the economic-financial ranking in tenth position. The third ranked in relation to sustainable performance was the company CEMIG, which had presented the second position in the environmental ranking, no standing out in the other groups.

These results show the importance of evaluating organizations as a whole, holistically and in a general context, considering the economic prosperity, environmental quality and social progress of companies (Liern & Pérez-Gladish, 2018). This is because, as verified, the segmented analysis of organizational sustainability, that is, the individual analysis of environmental or social aspects can only lead to partial conclusions related to an organization.

This need for a holistic analysis of sustainability has already been reported in the bibliographic review made by Gbededo, Liyanage and Garza-Reyes (2018), when they evidenced the scarcity of research that analyzes sustainability with a holistic approach, integrating environmental, social and economic-financial aspects. Most most studies focus on segmented analyses, examining only a single aspect of sustainability, which makes it difficult to understand the overallsituation of organizations in view of the preservation of sustainability.

These results also highlight the importance of analyzing organizational sustainability as a multidimensional aspect, that is, that addresses environmental, social and economic-financial issues (Elkington & Burke, 1989). This is because the individual analyses of environmental or social aspects may not show the totality of the reality of organizations, as evidenced in the results of this investigation.

This holistic analysis of sustainability has also been addressed by Costanza *et al*. (2016), when discussing that the dimensions of sustainability (environmental, social and economic-financial) are not aspects with independent objectives in organizations, that is, these dimensions are interconnected, aiming to develop the organization as a whole.

5 CONCLUSIONS

To achieve the objective of this study, which sought to evaluate the environmental, social and economic-financial performance of Brazilian companies based on game theory, performance rankings were obtained for each group of indicators using scalar games. In addition, a general ranking was developed using the vector model for sustainability analysis. Thus, four rankings were prepared: a ranking of environmental performance, a ranking of social performance, a ranking of economic and financial performance and a ranking of sustainable performance.

This study covered a longitudinal analysis of the sustainable information of the analyzed companies, since the period from 2010 to 2017 was analyzed. Thus, it was possible to verify that the classification of companies varied according to the years and according to the group of indicators analyzed. Thus, the results showed that, according to sustainable

performance, the best ranked companies are Vale SA, Telefônica Brasil SA and CEMIG. However, these companies do not hold the same classification when environmental, social, and economic-financial indicators were analyzed individually.

It is also noteworthy that, despite some companies achieving prominent positions in the overall ranking, Vale SA experienced a decline in performance in recent years. This decline is a cause for concern and highlights the need for a detailed analysis of its indicators as well as strategies and policies adopted and implemented. Therefore, this research sought to contribute to the previous studies showing the importance of analyzing several indicators simultaneously to assess a company's performance and to point to the different degrees of performance in relation to the groups of indicators that form the tripod of sustainability.

This study has some methodological limitations that should be considered. The analysis was restricted to the period from 2010 to 2017 and to the sample of specific companies on the B3 stock exchange that had data available in the Thomson Reuters® database, which may limit the generalizability of the results to other contexts and periods. Furthermore, the choice of game theory as a classification method may not fully capture the complexity of the interactions among sustainability indicators, and different results could potentially be obtained using other statistical or multicriteria methodologies.

For future research, it is recommended to explore new methodologies for classifying and analyzing organizational performance. Attention should also be given to the indicators and positions of the companies evaluated in this study that showed a decline in performance over the period, such as Vale SA, and to the factors that may have caused this drop.

REFERENCE

Aris, N. A., Marzuki, M. M., Othman, R., Rahman, S. A., & Ismail, N. H. (2018). Designing indicators for cooperative sustainability: The Malaysian perspective. *Social Responsibility Journal*. https://doi.org/10.1108/SRJ-01-2017-0015

Bell, S., & Morse, S. (2005). Holism and understanding sustainability. *Systemic Practice and Action Research*, *18*(4), 409-426. https://doi.org/10.1007/s11213-005-7171-9

Bezerra, F. A., & Corrar, L. J. (2006). Utilização da análise fatorial na identificação dos principais indicadores para avaliação do desempenho financeiro: uma aplicação nas empresas de seguros. *Revista Contabilidade & Finanças*, *17*(42), 50-62. https://doi.org/10.1590/S1519-70772006000300005

Boff, L. H., Procianoy, J. L., & Hoppen, N. (2006). O uso de informações por analistas de investimento na avaliação de empresas: à procura de padrões. *Revista de Administração Contemporânea*, *10*(4), 169-192. https://doi.org/10.1590/S1415-65552006000400009

Boiral, O., & Henri, J. F. (2017). Is sustainability performance comparable? A study of GRI reports of mining organizations. *Business & Society*, *56*(2), 283-317. https://doi.org/10.1177/0007650315576134

Bortoluzzi, S. C., Ensslin, S. R., & Ensslin, L. (2011). Avaliação de desempenho multicritério como apoio à gestão de empresas: aplicação em uma empresa de serviços. *Gestão & Produção*, *18*(3), 633-650. https://doi.org/10.1590/S0104-530X2011000300014

Brito, L. A. L., & Vasconcelos, F. C. D. (2005). Desempenho das empresas brasileiras: efeitos ano, ramo de negócios e firma individual. *Revista de Administração Contemporânea*, *9*(SPE1), 65-85. https://doi.org/10.1590/S1415-65552005000500004

Callado, A. A. C., Callado, A. L. C., & Almeida, M. A. (2008). O uso de indicadores de desempenho no âmbito das empresas do Porto Digital. In *8º Congresso USP Controladoria e Contabilidade*.

Callado, A. L. C. (2010). *Modelo de mensuração de sustentabilidade empresarial*: uma aplicação em vinícolas localizadas na Serra Gaúcha. 216f. Tese (Doutorado em Agronegócios) UFRGS – Universidade Federal do Rio Grande do Sul. Porto Alegre.

Camargos, M. A. de, & Barbosa, F. V. (2005). Análise do desempenho econômico-financeiro e da criação de sinergias em processos de fusões e aquisições do mercado brasileiro ocorridos entre 1995 e 1999. *REGE Revista de Gestão*, *12*(2), 99-115.

Cecon, B., Hein, N., & Kroenke, A. (2018). Associação do Disclosure Ambiental com o Valor de Mercado de Empresas Brasileiras. *Revista de Negócios*, *23*(2), 24-37. https://doi.org/10.7867/1980-4431.2018v23n2p24-37

Chen, C. S., Yu, C. C., & Hu, J. S. (2018). Constructing performance measurement indicators to suggested corporate environmental responsibility framework. *Technological Forecasting and Social Change*, *135*, 33-43. https://doi.org/10.1016/j.techfore.2017.05.033

Costanza, R., Daly, L., Fioramonti, L., Giovannini, E., Kubiszewski, I., Mortensen, L. F., ... & Wilkinson, R. (2016). Modelling and measuring sustainable wellbeing in connection with the UN Sustainable Development Goals. *Ecological Economics*, *130*, 350-355. https://doi.org/10.1016/j.ecolecon.2016.07.009

Cruz, B. D. P. A. (2017). Reputação como fonte de vantagem competitiva: uma análise exploratória para uma instituição de ensino superior. *Revista Magistro*, *1*(15).

Daniel, M. C., & Astruc, D. (2004). Gold nanoparticles: assembly, supramolecular chemistry, quantum-size-related properties, and applications toward biology, catalysis, and nanotechnology. *Chemical reviews*, *104*(1), 293-346.

Diegues, A. C. S. (1992). Desenvolvimento sustentável ou sociedades sustentáveis: da crítica dos modelos aos novos paradigmas. *São Paulo em perspectiva*, *6*(1-2), 22-29.

Dossa, Z., & Kaeufer, K. (2014). Understanding sustainability innovations through positive ethical networks. *Journal of Business Ethics*, *119*(4), 543-559. https://doi.org/10.1007/s10551-013-1834-8

Elkington, J., & Burke, T. (1989). *The green capitalists: How to make money-and protect the environment*. V. Gollancz.

Engebretsen, E., Heggen, K., & Ottersen, O. P. (2017). The Sustainable Development Goals: ambiguities of accountability. *The Lancet*, *389*(10067), 365-365.

Fiani, R. (2009). *Teoria dos jogos*: com aplicações em economia, administração e ciências sociais. 3. ed. Rio de Janeiro: Elsevier.

Gapenski, L. C., & Pink, G. H. (2007). *Understanding healthcare financial management*. Chicago: Health Administration Press.

Gbededo, M. A., Liyanage, K., & Garza-Reyes, J. A. (2018). Towards a Life Cycle Sustainability Analysis: A systematic review of approaches to sustainable manufacturing. *Journal of Cleaner Production*, *184*, 1002-1015. https://doi.org/10.1016/j.jclepro.2018.02.310

Gomes, C. E., da Silva, C., & Parré, J. L. (2017). Negociações entre a Grécia e seus credores à luz da teoria dos jogos. *Economic Analysis of Law Review*, 7(2), 510-529. https://doi.org/10.31501/ealr.v7i2.6803

Gomes, C. M., Kneipp, J. M., Kruglianskas, I., da Rosa, L. A. B., & Bichueti, R. S. (2014). Management for sustainability in companies of the mining sector: an analysis of the main factors related with the business performance. *Journal of Cleaner Production*, *84*, 84-93. https://doi.org/10.1016/j.jclepro.2013.08.030

Gómez-Bezares, F., Przychodzen, W., & Przychodzen, J. (2017). Bridging the gap: How sustainable development can help companies create shareholder value and improve financial performance. *Business Ethics: A European Review*, *26*(1), 1-17. https://doi.org/10.1111/beer.12135

Hay, J. E., Noonan, M. (2005). Anticipating the environmental effects of technology: a manual for decision-makers, planners and other technology stakeholders for the International Environmental Technology Centre, Osaka, Japan. *Online Report*: http://www. unep. or. jp/ietc/Publications/Integrative/EnTA/AEET/index. asp.

IAEA [International Atomic Energy Agency], UNDESA [United Nations Department of Economic and Social Affairs], IEA [International Energy Agency], EUROSTAT, EEA [European Environment Agency]. *Energy Indicators for Sustainable Development*: Guidelines and Methodologies. 2005.

Ittner, C. D., & Larcker, D. F. (1998). Are nonfinancial measures leading indicators of financial performance? An analysis of customer satisfaction. *Journal of accounting research*, *36*, 1-35. https://doi.org/10.2307/2491304

Jiang, Q., Liu, Z., Liu, W., Li, T., Cong, W., Zhang, H., & Shi, J. (2018). A principal component analysis based three-dimensional sustainability assessment model to evaluate corporate sustainable performance. *Journal of cleaner production*, *187*, 625-637. https://doi.org/10.1016/j.jclepro.2018.03.255

Kroenke, A., Caballero, V. R., Cecon, B., & Hein, N. (2018). Scalar And Vector Games In The Evaluation Of Social And Environmental Disclosure And Their Relationship With Market Value. *Pesquisa Operacional*, *38*(2), 215-246. https://doi.org/10.1590/0101-7438.2018.038.02.0215

Laffranchini, G., & Braun, M. (2014). Slack in family firms: evidence from Italy (2006-2010). *Journal of Family Business Management*. https://doi.org/10.1108/JFBM-04-2013-0011

Li, Y., & Mathiyazhagan, K. (2018). Application of DEMATEL approach to identify the influential indicators towards sustainable supply chain adoption in the auto components manufacturing sector. *Journal of cleaner production*, *172*, 2931-2941. https://doi.org/10.1016/j.jclepro.2017.11.120

Liern, V., & Pérez-Gladish, B. (2018). Ranking corporate sustainability: A flexible multidimensional approach based on linguistic

variables. *International Transactions in Operational Research*, *25*(3), 1081-1100. https://doi.org/10.1111/itor.12469

Magon, R. B., Thomé, A. M. T., Ferrer, A. L. C., & Scavarda, L. F. (2018). Sustainability and performance in operations management research. *Journal of cleaner production*, *190*, 104-117. https://doi.org/10.1016/j.jclepro.2018.04.140

McLean, R. (2002). *Financial management in health care organizations*. Cengage Learning, 2002.

Morel, C. H. G. S., dos Santos, G. C., Francisco, A. P., & de Carvalho Paranaiba, A. (2019). Análise da correlação entre o modelo fleuriet e os indicadores de rentabilidade e liquidez para as maiores e melhores empresas de capital aberto segundo a revista exame. *Brazilian Journal of Development*, *5*(2), 1399-1421. https://doi.org/10.34117/bjdv5n2-1117

Nascimento, J. C., Kroenke, A., & Marcos, C. (2016). Efeito da Participação no Índice de Sustentabilidade Empresarial (ISE) no Desempenho Econômico-Financeiro das Empresas do Setor de Transporte. In.: *Congresso USP Controladoria e Contabilidade*.

Neely, A. D., Adams, C., & Kennerley, M. (2002). *The performance prism:* The scorecard for measuring and managing business success. London: Prentice Hall Financial Times.

Nossa, V., Rodrigues, V. R. S., & Nossa, S. N. (2017). O que se tem pesquisado sobre Sustentabilidade Empresarial e sua Evidenciação?. *Revista de Educação e Pesquisa em Contabilidade*, *11*, 87-105.

Porter, M. E., Kramer, M. R. (2011). The Big Idea: Creating Shared Value. How to reinvent capitalism - and unleash a wave of innovation and growth. *Harvard Business Review*, v. 89, n. 1-2. https://doi.org/10.1007/978-94-024-1144-7_16

Porter, M., & Van der Linde, C. (1995). Green and competitive: ending the stalemate. *The Dynamics of the eco-efficient economy*: environmental regulation and competitive advantage, *33*.

Schuhmann, T. M. (2008). Hospital financial performance: trends to watch: financial indicators derived from Medicare cost report data are reliable tools for assessing the effectiveness of a hospital's operations. *Healthcare financial management*, *62*(7), 58-67.

Silva, D. M. I., Rodrigues, D. D. S. S., de Castro Sousa, J., Nascimento, K. M. M., & Vieira, L. F. (2019). As contribuições do plano de negóciospara o desempenho organizacional: um estudo de caso longitudinal dos indicadores de liquidez e endividamento de uma franquia no ramo alimentício. *Brazilian Journal of Development*, *5*(2), 1136-1158. https://doi.org/10.34117/bjdv5n2-1081

Stoycheva, S., Marchese, D., Paul, C., Padoan, S., Juhmani, A. S., & Linkov, I. (2018). Multi-criteria decision analysis framework for sustainable manufacturing in automotive industry. *Journal of Cleaner Production*, *187*, 257-272. https://doi.org/10.1016/j.jclepro.2018.03.133

Tan, J., & Peng, M. W. (2003). Organizational slack and firm performance during economic transitions: Two studies from an emerging economy. *Strategic management journal*, *24*(13), 1249-1263. https://doi.org/10.1002/smj.351

Vellani, C. L., & de Souza Ribeiro, M. (2009). Sustentabilidade e contabilidade. *Revista Contemporânea de Contabilidade*, *6*(11), 187-206. https://doi.org/10.5007/2175-8069.2009v6n11p187

WCED, Special Working Session. (1987). World commission on environment and development. *Our common future*, v. 17, p. 1-91.

Xie, J., Nozawa, W., Yagi, M., Fujii, H., & Managi, S. (2019). Do environmental, social, and governance activities improve corporate financial performance?. *Business Strategy and the Environment*, *28*(2), 286-300. https://doi.org/10.1002/bse.2224