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Contributions from the Brazilian industrial sector to sustainable development

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ABSTRACT

This paper aims to evaluate the perception of experts on the contribution of the Brazilian industrial sector in terms of sustainable development, focusing in particular on three of the 17 Sustainable Development Goals (SDG) presented by United Nations (UN). A survey was conducted with professionals from Brazilian industry in order to identify their perceptions. It obtained sixty one answers and the collected data was evaluated technically and descriptively by TOPSIS analysis. It was found that Brazil has been carrying out some relevant actions, both sporadic and planned, with significant opportunities for improvement. Comparatively, the most cited contributions are those related to increasing productivity and technological modernization, which contributes to the inclusion of young people in the labor market, improving resource efficiency and the minimization of environmental degradation. Conversely, the least cited contributions are those related to the stimulation of sustainable consumption and negotiation with small companies. Therefore, the authors believe that the findings of this research could be useful for professionals and academics as guidance. It is also important to mention that no similar paper was found with an academic basis, which reinforces the originality and the contribution of this paper.

1. Introduction

Over the last number of decades, companies are increasingly being demanded to take greater responsibility for their actions (Arruda et al., 2013; Barata et al., 2014; Chams and García-Blandón, 2019; Maruyama et al., 2019b). It is no longer just economic and competitive considerations that are driving organizations: ethical, environmental and social subjects are also affecting organizations' behavior (Chams and García-Blandón, 2019; Maruyama et al., 2019a; Virakul and Russ-Eft, 2019). Concepts such as Corporate Social Responsibility, Green Supply Chain Management, Sustainable Manufacturing and Cleaner Production have gradually taken over a representative function in the strategic aspects of an organization (Cazeri et al., 2017; Chams and García-Blandón, 2019; Matos et al., 2018; Nikolaou et al., 2019).

This scenario is linked to the definition of sustainable development presented in the Brundtland report (Ashrafi et al., 2018; Poltronieri et al., 2019; Sinakou et al., 2018; Singh et al., 2018). According to this document, sustainable development is defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 16). Based on this definition, it can be inferred that organizations must not stop their growth in order to prevent negative impacts over the planet. Therefore, organizations can grow in a sustainable way based on the best use of resources that enables a good quality of life for future generations.

Focusing on corporate sustainability, Satyro et al. (2017) consider this issue as rarely implemented in an organizational context, although there are companies that properly implement aspects of sustainability in their activities. Sustainable actions must be considered at all levels of an organization to be effective. More specifically, these actions should be inserted at the strategic,

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technological, managerial, organizational and behavioral levels (Blok et al., 2015; Virakul and Russ-Eft, 2019). Arbolino et al. (2018) highlight the importance of government policies in order to direct organizations towards sustainable management.

The scenario mentioned by Satyro et al. (2017) corresponds with the reality in Brazil. Most of the organizations in Brazil are underdeveloped regarding sustainability issues, but a few of them do demonstrate excellence when it comes to sustainable development. This consideration is based on studies by Anholon et al. (2016) and Cazeri et al. (2018). Anholon et al. (2016) evaluated one specific Brazilian aerospace company and confirmed that the development of its environmental and social projects fully integrated with its management systems and strategies. On the opposite side, Cazeri et al. (2018) found that Brazilian companies, in general, do not properly integrate sustainable practices within their management systems and little attention is given to the planning of sustainability practices in the Brazilian context.

When it comes to industrial activities, it is observed that its negative impacts on the environment and society have grown considerably in the last two centuries (Dias, 2011). Due to these impacts, industrial sustainability has been a focus for researchers, policy-makers and decision-makers (Cagno et al., 2019). Evidently, the industrial sector plays a fundamental role in the search for a better future. Sustainability has been shown to positively influence industrial performance, even when taking into account the barriers to its implementation and its low adoption rates in some countries (Neri et al., 2018; Trianni et al., 2017).

The publication of the Sustainable Development Goals (SDG) by the United Nations (UN) has greatly contributed to the broadening of debates related to the insertion of sustainability in industrial activities, although this is a not recent theme (Gutowski et al., 2005; Monteiro et al., 2019). In September 2015, world leaders met in New York and formulated an action plan to eradicate poverty, protect the planet and ensure that people achieve peace and prosperity (Ipea, 2018; Spaiser et al., 2019; UN, 2019). The action plan resulted in 17 SDGs that aim to direct countries towards a better future for all citizens. These SDGs constitute an ambitious list of tasks for all parties to accomplish by 2030. Achieving these goals ensures the eradication of extreme poverty and saves future generations from adverse effects such as climate change (Ipea, 2018; Spaiser et al., 2019; UN, 2019). Despite the relevance of the SGDs for the industrial sector, there is little research addressing this issue.

For Govindan et al. (2019), an important method for the industrial sector to contribute to the SDGs is through the sharing economy. In order to contribute to this field of research, the authors identified the main barriers to the sharing economy in the Indian industrial sector. In their study, the most influential barrier was related to the lack of trust while the least influential barrier was the cost of capital.

Focusing on chemistry industry, Makarova et al. (2019) highlight the negative impacts of its activities on the environment, largely because of the pollutants generated. In this sense, the SDGs are a relevant driver for this industry, demonstrating the need to change both consumption and production patterns (SDG 12), as well as the need to mitigate climate change (SDG 13). To contribute to these goals, Makarova et al. (2019) developed an algorithm to evaluate the environmental key performance indicators of companies from this sector that participate in the global voluntary Responsible Care® Program (RCP). According to their findings, although several direct environmental impacts (e.g. pollution of water and soil) of these companies decreased, their greenhouse gas emissions are still increasing.

Mancini and Sala (2018) highlight the negative social and environmental impacts generated by the mining sector and the consequent role of this sector for the SDGs. As well as the SDGs, the authors used Global Reporting Initiative (GRI), EU Better Regulation policy, and the Social Life Cycle Assessment (SLCA) as frameworks to compare the impacts collected from the literature and to evaluate the results. Their findings highlighted the difference between frameworks to represent problems related to local scales, since, for example, GRI provides a better understanding of these issues than SLCA and the SDGs.

Since the SDGs focus on sustainable development, all 17 of the goals can be addressed by companies. However, since the focus of this research is the industrial sector, a selection was made to study the most relevant goals for these companies. When analyzing the SDGs, it is possible to note that industrial activities, in general, are directly related to three of the SDGs. Namely, they are related to: Decent Work and Economic Growth (SDG number 8); Industry, Innovation and Infrastructure (SDG number 9); and Responsible Consumption and Production (SDG number 12). SDG number 8 focuses on the pursuit of self-respecting economic growth that improves organizational competence and provides better living conditions for people aligned with economic growth. Although the targets of SDG number 8 mention the importance of innovation and technological advances, it is SDG number 9 that gives these topics more prominence. In addition to innovation, SDG number 9 underlines the importance of establishing adequate infrastructure and of sustainable industrialization maximizing the use of clean processes and technologies that positively contribute to economic growth, job creation and the efficient use of natural resources. The efficient use and management of natural resources are also mentioned in SDG number 12, which emphasizes the importance of seeking sustainable standards not only in production but also in consumption (UN, 2019).

Considering that companies are increasingly demanded by society to act towards sustainable development (Chams and García-Blandón, 2019; Rampasso et al., 2020; Virakul and Russ-Eft, 2019) and that since 2015, the SDGs have been important drivers for sustainability in several spheres, including industry (Nobrega et al., 2019), it is important to understand how different countries' companies are dealing with these challenges. Therefore, studies on a national scale are necessary and can be identified as a research gap. In this sense, the following question arises as a scientific research objective: "how has the Brazilian industrial sector contributed to the achievement of SDG number 8, SDG number 9 and SDG number 12?". This paper focuses specifically on the industrial sector and considers the SDGs as an analysis framework. This represents a fundamental difference between the evaluation performed by Cazeri et al. (2018). The next section presents the methodological procedures conducted in this research.

2. Methodological procedures

As previously mentioned, this research aims to verify the contributions of the Brazilian industrial sector in relation to SDGs 8, 9 and 12. To achieve this, a survey with experts was used to collect data used in a descriptive analysis via the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) technique. TOPSIS enables one to rank items according to different criteria and weight the criteria according to a pre-defined degree of importance (Rampasso et al., 2019; Singh et al., 2016). In this research, the respondents were divided into groups and these groups received different weights according to their experience. The respondent scores for sustainability issues were the items ordered.

Before presenting the steps followed in this research, the scientific research classification based on classical criteria and details regarding the applied methodological procedures are outlined. Concerning the classical criteria and from the perspective of methodological strategies, this research applied both a literature

review and a survey. As a result of these methods, this research presents both qualitative and quantitative characteristics. According to the objectives of this paper, this research is exploratory, and follows a widely used methodology for exploratory studies developed by Stebbins (2001) which considers a questionnaire as an instrument for data collection (Gil, 2010; Gray, 2012; Malhotra, 2012). The exploratory character of this research is justified by the lack of information regarding the Brazilian industrial sector when it comes to sustainable development goals. Other interesting examples of exploratory research, literature reviews and case studies can also be cited (Malhotra, 2012).

When it comes to the methodological procedures of this work, the authors of this paper designated six well-defined phases to properly present the steps taken. Fig. 1 shows each phase detailed and the relationship between them.

The first phase is characterized by the literature review with a purpose to present a basis on sustainability in the industrial context. In the next phase, the 17 SDGs were carefully scanned considering the information available in UN (2015) and Ipea (2018). A greater emphasis was given to Decent Work and Economic Growth (SDG number 8); Industry, Innovation and Infrastructure (SDG number 9); and Responsible Consumption and Production (SDG number 12) due to their strict focus on industrial activities.

Taking these three SDGs into account, Table 1 was structured in order to serve as a reference for the elaboration of the questionnaire. The aim of Table 1 is to summarize the targets presented in SDG number 8, SDG number 9 and SDG number 12. All of these targets were taken from UN and Ipea. When possible, similar or complementary targets were grouped.

Each of the ten targets presented in Table 1 was evaluated by expert professionals in terms of the extent to which it is being applied in companies in Brazil. The experts (respondents) were required to assign a score from 0 to 10 to each target based on their experience of the context in which companies in Brazil operate. The scores were grouped in pairs, as shown in Table 2, to allow respondents to fine tune their responses. The definitions of each score level was developed by the authors of this article.

Concerning data collection, an electronic questionnaire was used and was available during a period of four months on the Google Forms platform. It is also important to note that this questionnaire – and the entire research project – was approved by an Ethics Committee, a practice required in Brazil for research that requires interaction with other people.

After the period of questionnaire availability, a total of sixty-one (61) valid answers were received, representing a return rate of 13.26%. The sample of respondents obtained is composed of professionals with undergraduate degrees. Most of them had at least one postgraduate degree (MBA, master's degree, doctoral degree, etc.). They work in the following sectors: construction, education, oil and gas, food and beverage, and automotive, among others. In order to obtain a heterogeneous sample, the sample selection did not focus on any sector in particular. However, the questionnaire was only sent to respondents who were considered experts after a curriculum analysis.

The collected data was tabulated in electronic spreadsheets and analyzed from the point of view of averages. Subsequently, the TOPSIS technique was used for the comparative ordering of the items presented in Table 1. The TOPSIS technique was devised by Hwang and Yoon (1981) and has been widely used in academic research (Yoon and Kim, 2017). An important feature of the TOPSIS is that it allows for the weighting of certain analysis criteria according to their greater importance for what is being investigated. In this specific case, we weighted the answers attributed according to the work experience of respondents. This decision was taken because we understand that those who have been in the Brazilian industrial context longer have a greater ability to make conclusions about it. Subsequently, the following weights were chosen: 50% for specialists with more than 20 years of work experience, 30% for specialists with work experience between 10 and 20 years and 20% for specialists with up to 10 years of work experience. This weighting was also considered by Rampasso et al. (2019).

TOPSIS calculations followed the steps presented by Singh et al. (2016). In the first step, a matrix D should be structured. This matrix is composed of elements (x_{ij}), in which (i) represents each item analyzed and (j) represents each analysis criterion (in this case, the means measured by each group according to their degree of experience). These elements are calculated using the averages of each respondents' group for each analyzed item. The mathematical representation adopted for matrix D is presented in Fig. 2.

The next step corresponds to the normalization of matrix D according to Equation (1). Since equation (1) is used for each element from Matrix D, a new matrix is obtained and it is named matrix R (Fig. 3) (Singh et al., 2016).

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^2}} \quad (1)$$

Normalization equation.

The third step consists of weighting the elements of matrix R using the weights that correspond to each respondent based on their years of work experience - 50%, 30% and 20%. This is done through Equation (2) and Fig. 4.

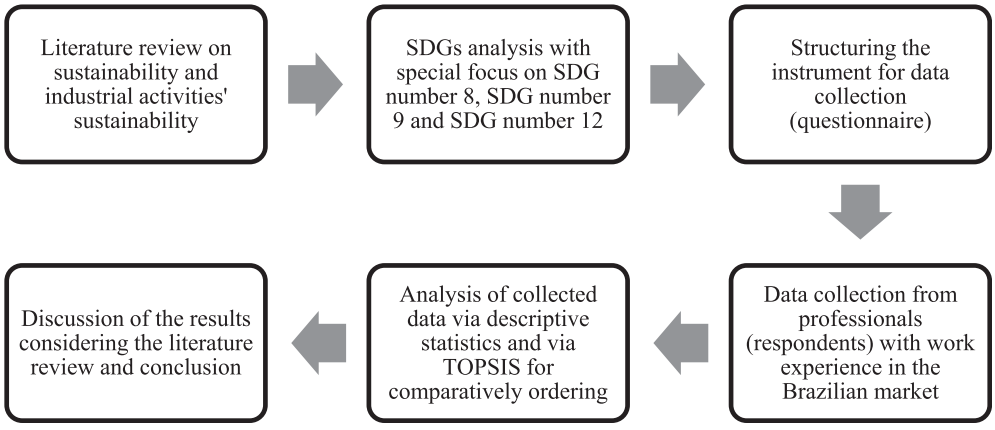

Fig. 1. Methodological procedures phases. Source: Authors.

Table 1
Targets considered for questionnaire elaboration. Source: Compiled from (Ipea, 2018; UN, 2015).

1) Achieve higher levels of productivity and technological modernization (based on targets from SDG number 8)
2) Act together with the responsible agencies in a sectoral manner for the creation of national policies associated with the development of productive activities (based on targets from SDG number 8)
3) Improve efficiency in resource utilization throughout the productivity network based on the reduction, recycling and reuse of resources (based on targets from SDG number 8, 9 and 12)
4) Increasingly seek industrial growth that minimizes environmental degradation and promotes an inclusive and sustainable industrialization (based on targets from SDG number 8, 9 and 12)
5) Provide employment for women and men with equal pay (based on targets from SDG number 8)
6) Contribute to the insertion of young people in the labor market by providing education and professional training (based on targets from SDG number 8)
7) Invest in scientific research related to the industrial sector and support the development of national technology (based on targets from SDG number 9).
8) Whenever possible, do business with small companies and help them to have greater market integration (based on targets from SDG number 9).
9) Encourage sustainable consumption from consumers to minimize unnecessary consumption (based on targets from SDG number 12)
10) Develop and implement management tools and models that allow better analysis of sustainable aspects (environmental, economic and social) (based on targets from SDG number 12)

Table 2
Scores and corresponding degree to which the target is applied. Source: Authors.

Score 0: The target is not applied by companies operating in Brazil;
Score 1 or 2: The target is applied to a minimal extent by companies operating in Brazil and there is an initial discussion about this subject by companies operating in Brazil;
Score 3 or 4: The target is applied superficially by companies operating in Brazil and there are simple and isolated actions taken for this target by companies operating in Brazil;
Score 5 or 6: The target is applied in a standardized manner by companies in Brazil, but there are ample opportunities for improvement;
Score 7 or 8: The target is applied in a standardized manner by companies in Brazil but the efforts to achieve it are assigned individually and are not supported by a work team;
Score 9 or 10: The target is applied in a standardized manner by companies in Brazil which is achieving good results and the efforts to achieve it are supported by a work team.

$$D = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}$$

Fig. 2. Matrix D.

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix}$$

Fig. 3. Matrix R.

$$V = \begin{bmatrix} v_{11} & v_{12} & \cdots & v_{1n} \\ v_{21} & v_{22} & \cdots & v_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ v_{m1} & v_{m2} & \cdots & v_{mn} \end{bmatrix}$$

Fig. 4. Matrix V.

$$v_{ij} = w_j r_{ij} \tag{2}$$

Weighting equation.

The fourth step is characterized by the definition of the positive ideal solution (vj^+) and the fifth step is characterized by the definition of the negative ideal solution (vj^-). The definition of positive ideal solution corresponds to the vector composed by the maximum values of each of the columns of matrix V; the second definition of the positive ideal solution corresponds to the vector composed of the minimum values of each of the columns of matrix V. The identification of these vectors allows for the calculation of Euclidean distances for each item in relation to the positive and negative solution. These calculations are performed using the equations presented in Equations (3) and (4).

$$s_i^* = \left[\sum_j \left(v_{ij}^* - v_j^+\right)^2\right]^{1/2} \tag{3}$$

Positive Euclidean distance calculation

$$s_i' = \left[\sum_j \left(v_{ij}' - v_j^-\right)^2\right]^{1/2} \tag{4}$$

Negative Euclidean distance calculation.

With the positive and negative Euclidean distances calculated, it is possible to perform the sixth step that corresponds to the calculation of the indicator C_i^*, using the equation presented in Equation (5). This indicator ranges from 0 to 1 and it is used to perform the comparative analysis between the targets presented in Table 1 (Singh et al., 2016).

$$c_i^* = \frac{s_i'}{\left(s_i^* + s_i'\right)} \tag{5}$$

Calculation of C_i^* indicator.

Once the indicators C_i^* are obtained, it is possible to comparatively order the targets presented in Table 1 and the conclusions about this scientific research can be established.

3. Results and discussions

Fig. 5 presents the averages assigned by each group of respondents for each of the 10 items studied. These averages are used in the next steps presented.

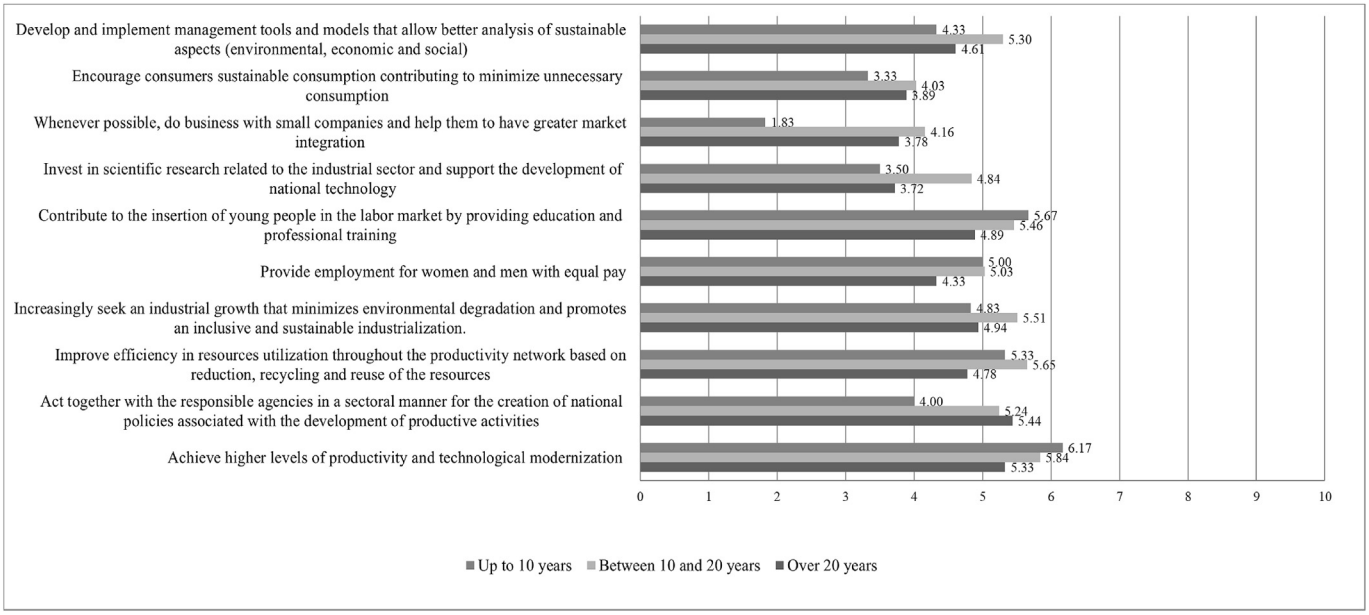

Fig. 5. Averages assigned by groups for each item.

Considering the averages resulting from the grades awarded by the specialists with the longest experience in the Brazilian industrial context (over 20 years), only two of the ten items analyzed presented averages higher than 5.0. These items are related to sectoral performance and the achievement of higher levels of productivity and technological modernization, and there are ample opportunities for improvement in these areas. In general, the respondents believed that most of the actions developed by Brazilian industry are in the transition between simple and sporadic actions (taken irregularly and without planning) and planned and regular actions, but with ample opportunities for improvement. Given this scenario, Djonú et al. (2018) highlight the importance of coherent action by the industrial sector in order to achieve sustainable goals. Kuzma et al. (2017) corroborate this view and highlight the importance of sustainable development in organizations.

When analyzing the averages resulting from the responses of specialists with between ten and twenty years of experience, it is possible to observe that they are generally higher than the average scores obtained by the specialists from the first group: between 5 and 6. That is, for most of the items analyzed, the means denote that the actions are planned, but that there are possibilities for improvement. Only three items had averages below 5.0. These items were related to stimulating sustainable consumption, negotiating with small companies and investing in scientific research. For these areas, the actions are simple and sporadic. According to Morioka and Carvalho (2017), companies have a fundamental role in the diffusion of conscious consumption and the implementation of practices that allow for processes with less impact on the environment and society. In addition, Szücs (2018) and Saunila et al. (2019) argue that investments in scientific research for the development of technologies in the industrial sector can greatly contribute to the development of this sector and the achievement of sustainable development goals. Further, Hurtado-torres et al. (2008) highlight the social and economic importance of integrating small businesses into the labor market.

The latter group, composed of experts with up to ten years of experience, showed wide variation in terms of analysis. For four of the items, the average experts judged that Brazilian industry has been developing actions in a planned manner, but with ample possibilities for improvements in its results. These improvement opportunities are associated with achieving higher levels of productivity, improving resource efficiency, providing employment for women and men with equal pay, and contributing to the inclusion of young people in the labor market by providing education and vocational training. One item that should be highlighted in this group of experts is the topic related to trading with small companies, which averaged only 1.83. In the context of the survey, for this item, this would mean that Brazil has not been carrying out any action, and there are only discussions about the theme. Hurtado-torres et al. (2008) reinforce the idea that small companies are important to industry, generating jobs and opportunities for the entire population. For the other five items, the average showed that Brazilian industry has been performing some actions in a simple and timely manner.

According to these first analyses of averages, even without considering the weights attributed to each group, it is possible to realize that Brazilian industry still needs to leverage its actions in favor of more sustainable results.

Next, there was also a comparative ordering of items using the TOPSIS technique, which enabled a more integrated view. Based on the averages presented in Fig. 1 for each item by each group, the matrix D was structured. This was normalized through Equation (1), giving rise to the matrix R presented in Table 3.

The values of Matrix R presented in Table 3 were taken into

Table 3
R matrix with normalized values.

Items	rij (over 20 years)	rij (between 10 and 20 years)	rij (up to 10 years)
I_1	0.37	0.36	0.43
I_2	0.37	0.32	0.28
I_3	0.33	0.35	0.37
I_4	0.34	0.34	0.33
I_5	0.30	0.31	0.35
I_6	0.34	0.34	0.39
I_7	0.26	0.30	0.24
I_8	0.26	0.26	0.13
I_9	0.27	0.25	0.23
I_10	0.32	0.33	0.30

Table 4
Matrix V with weighted values.

Items	rij (over 20 years)*0.50	rij (between 10 and 20 years)*0.30	rij (up to 10 years)*0.20
I_1	0.18	0.11	0.09
I_2	0.19	0.10	0.06
I_3	0.16	0.10	0.07
I_4	0.17	0.10	0.07
I_5	0.15	0.09	0.07
I_6	0.17	0.10	0.08
I_7	0.13	0.09	0.05
I_8	0.13	0.08	0.03
I_9	0.13	0.07	0.05
I_10	0.16	0.10	0.06

Table 5
Positive ideal and negative ideal solution.

Solution criteria	Over 20 years	Between 10 and 20 years	Up to 10 years
Positive ideal solution (vj^+)	0.19	0.11	0.09
Negative ideal solution (vj^-)	0.13	0.07	0.03

Table 6
Distances of the positive ideal solution, distance of the negative ideal solution and coefficient C_i*. Organizing the items according to the value of the coefficient C_i*, results in Table 7 in which the items are ranked.

Items	Distances from (S_i*)	Distances from (S_i')	Coefficient (C_i*)
I_1	0.00	0.09	0.96
I_2	0.03	0.07	0.69
I_3	0.03	0.07	0.72
I_4	0.03	0.07	0.71
I_5	0.04	0.05	0.54
I_6	0.02	0.07	0.77
I_7	0.07	0.03	0.28
I_8	0.09	0.00	0.03
I_9	0.07	0.02	0.23
I_10	0.04	0.05	0.57

consideration and gave rise to matrix V presented in Table 4. It is worth remembering that the weighting used Equation (2) and implemented a 50% weight for specialists with more than 20 years of experience, a weight of 30% for specialists with 10–20 years of experience and 20% for specialists with up to 10 years of experience.

The next step corresponded to the determination of the positive and negative ideal solution, and these vectors are presented in Table 3. Through Equations (3) and (4), the values presented in Tables 4 and 5 were used to calculate the Euclidean distances of the solutions, S_i* and S_i'. Finally, using Equation (5), we calculated the coefficient Ci* which enabled the comparative ordering of the items. All calculated values are presented in Table 6.

The results of ordering via TOPSIS highlight that "achieving higher levels of productivity and technological modernization", "contributing to the inclusion of young people in the labor market", "improving resource efficiency throughout the production network" and "seeking industrial growth that minimizes degradation" are, comparatively, the environmental actions of Brazilian industries that represent the greatest degree of progress in the search for a more sustainable future. Again, it is noteworthy that this does not mean a "degree of excellence", because – as evidenced earlier – there are still possibilities for improvements in the actions taken. In the last positions, we highlight the stimulus to sustainable consumption with consumers and the possibility of negotiating with small companies. Comparatively, these actions need to evolve the most. Industrial sustainability is characterized as an elementary factor for achieving a better future (Barboza et al., 2017; Govindarajulu and Daily, 2004; Zanchetta Borghi, 2017) and for achieving SDGs 8, 9 and 12.

In this sense, although all targets demonstrate opportunities for improvement – which corroborates to Cazeri et al. (2018) findings – the obtained rankings show the most critical issues. Regarding the incentive of sustainable consumption, companies still have difficulties reconciling their business model with sustainable development and they need to innovate their business model to align with the needs of the world (Minatogawa et al., 2019). Their innovations should be towards a circular economy in order to align these needs with companies' survival (Welch and Southerton, 2019). In relation to small business integration, besides the importance of the integration of this for social sustainability (Cazeri

Table 7
Ranking of the items.

Position	(C_i*)	Code	Items
1°	0.9590	I_1	Achieve higher levels of productivity and technological modernization.
2°	0.7710	I_6	Contribute to the insertion of young people in the labor market by providing education and professional training.
3°	0.7245	I_3	Improve efficiency in resources utilization throughout the productivity network based on reduction, recycling and reuse of the resources.
4°	0.7143	I_4	Increasingly seek an industrial growth that minimizes environmental degradation and promotes an inclusive and sustainable industrialization.
5°	0.6856	I_2	Act together with the responsible agencies in a sectoral manner for the creation of national policies associated with the development of productive activities.
6°	0.5673	I_10	Develop and implement management tools and models that allow better analysis of sustainable aspects.
7°	0.5418	I_5	Provide employment for women and men with equal pay.
8°	0.2766	I_7	Invest in scientific research related to the industrial sector and support the development of national technology.
9°	0.2255	I_9	Encourage consumers sustainable consumption contributing to minimize unnecessary consumption.
10°	0.0345	I_8	Whenever possible, do business with small companies and help them to have greater market integration.

et al., 2018), it is also beneficial for countries' economy and should be sought through supply chain management (Kot, 2018).

4. Conclusions

Through the presented results it is possible to observe that the proposed objective for the research was reached. The objective was to analyze the perception of experts in relation to the contributions of the Brazilian industrial sector to sustainable development, and more specifically, regarding the SDGs 8, 9 and 12, as presented by the UN (2019). The main conclusion from this research is that, in general, Brazil has been carrying out some actions, some of them sporadically and others in a planned way, but always with ample opportunities for improvement. Comparatively, the most advanced actions are those related to increasing productivity and technological modernization, contributing to the insertion of young people in the labor market, improving resource efficiency and seeking to minimize environmental degradation. The least advanced actions are those linked to stimulating sustainable consumption and negotiating with small companies.

The work undertaken as part of this paper has some limitations. The first is the scope of the methodology. Whereas exploratory research is a well-established procedure and is deployed when investigating a problem which is not clearly defined, it is usually carried out when the problem is at a preliminary stage, and hence cannot be regarded as suitable when addressing complex issues. In addition, the assumptions regarding weights for each respondent group also can be considered a limitation, but it is worth highlighting that the weights were assigned to attribute a greater relevance for answers from more experienced professionals. Moreover, the use of a non-probabilistic sample does not allow for a wider generalization of the results.

However, these limitations should not distract from the fact that the paper has some innovative features. First and foremost, the method used was adequate when it came to the circumstances in which they were deployed. Secondly, the sources of information are reliable since the respondents were selected for their professional experience and qualifications. In addition, this study is one of the few examples of academic research which has specifically looked at matters related to sustainable development in Brazilian industry. Furthermore, the information presented here will be valuable for future discussions about the future engagement of industry with sustainability issues. The authors of this study believe that the findings presented here can contribute to future developments in three spheres. Firstly, researchers can create roadmaps to guide companies towards implementing the SDGs. Further, since companies are under increasing pressure to consider sustainability aspects in their activities, the information presented in this article can support professionals' decisions on this issue. The findings presented here can also be valuable for policy makers to debate industrial sector policies; therefore, defining ways for companies to seek sustainable development within their activities.

In addition to the proposed roadmaps to be created by researchers, it also should be highlighted that future studies can be developed in relation to the details of each of the ten items analyzed in this research, and broader international studies may be developed, allowing for comparisons between industrial activities in one or more countries.

CRediT authorship contribution statement

V.W.B. Martins: Conceptualization, Data curation, Writing - original draft. **I.S. Rampasso:** Methodology, Writing - original draft. **P.F.S. Siltori:** Formal analysis, Writing - original draft. **G.T. Cazeri:** Investigation, Writing - original draft. **R. Anholon:** Methodology, Supervision, Writing - original draft. **O.L.G. Quelhas:** Investigation, Writing - original draft. **W. Leal Filho:** Writing - original draft, Validation, Writing - review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jclepro.2020.122762.

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