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Climate Change Mitigation, Adaptation Practices, and Business Performance in Brazilian Industrial Companies

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Abstract: This study sought to analyze the level of adopted climate change mitigation and adaptation practices and their relationship with the performance of Brazilian industrial companies. The data were collected through an e-survey in 40 Brazilian industrial companies linked to the Carbon Disclosure Project (CDP) and analyzed using univariate and multivariate statistical methods. Mitigation and adaptation practices were adopted as independent variables against climate change, while performance parameters (financial, innovative, production, market, and export performance) were included as the dependent variables. Our findings indicate that Brazilian industrial companies have been adopting both corporate practices of mitigation and adaptation to climate change and show that there are relationships between mitigation and adaptation practices and different dimensions of corporate performance. This study contributes to scientific advancement and developing a theoretical model that addresses, in an integrated manner, managing climate change adaptation and mitigation practices and corporate performance.

Keywords: mitigation; adaptation; climate change; corporate performance

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1. Introduction

Climate change has become a major challenge for world leaders seeking to establish policies to manage and minimize the impacts on the ecosystem, which are represented by numerous risks to human health [1], agricultural production, food security, and the economy and development of countries [2,3]. The 2018 Intergovernmental Panel on Climate Change (IPCC) report estimated that human activities have caused approximately 1.0 °C of global warming in the pre-industrial period, with a likely range of 0.8 to 1.2 °C [4]. According to the report, if temperatures continue to increase at the current rate, global warming is expected to increase by 1.5 °C between 2030 and 2052 and bring catastrophic effects to the ecosystem and society. Therefore, the hazards to health, livelihoods, food security, water supply, human security, and economic growth are also expected to increase with global warming.

Given the above, the main agents of society, including businesses and the industry, must operate in line and allied with climate change policies. Research on climate issues and industry has focused on how companies adjust to changing business conditions in the face of new competitors, demands, and changes in political, economic, and legal conditions [5]. From this perspective, climate change and extreme weather events are only considered peripheral or generic risk factors in the business and management literature.

In Brazil, the industrial sector directly accounts for about 7% of greenhouse gas (GHG) emissions. Its capacity to generate growth and income and potential competitiveness make this sector one of the most critical actors in tackling climate change [6]. Actions related to mitigation and adaptation to climate change meet the national economic development goals;

thus, a low carbon economy may bring opportunities for the Brazilian industry and produce positive effects and economic growth. In recent years, the increasing integration of climate change into corporate strategies has increased the interest of management researchers in the climate issue [7]. However, there are still numerous gaps regarding theoretical contributions related to management, and some authors [8] have reported that few studies have assessed how companies respond to climate change.

The Paris Agreement signed in 2015 was an important measure, however, it alone does not impose limits applicable to the national emissions of the signatory countries. In order to reduce the emission of greenhouse gases and, consequently, mitigate climate change, it is necessary to implement more effective measures by countries in order to prioritize the generation of renewable energy and reduce the use of fossil fuels.

Other authors [9] have stated that it is essential to investigate the challenges and opportunities generated from the climate crisis and how organizations respond, especially in developing countries such as those in South America. In addition, the authors highlighted the importance of research analyzing how organizations develop practices to mitigate or adapt to climate change and improvements in organizational operations in international performance. In this sense, research in business management involves different aspects of climate change, including risks, opportunities, barriers, and coping strategies, albeit there still seems to be a lack in the scope of the strategic management of companies and the ability to influence company performance. Some efforts have been made to identify climate change impacts in the commodity sectors [10–12] and industrial and business processes [6,13], which allow inferring a significant impact of climate change on production and performance.

Given these scenarios, the fundamental question of this study is: How does adopting mitigation and adaptation practices relate to the performance of industrial companies? To this end, this study sought to analyze the level of adopting climate change mitigation and adaptation practices and their relationship with the performance of Brazilian industrial companies. In addition to the introduction, this paper is structured into five sections. The second section presents a literature review on the corporate practices of mitigation and adaptation to climate change, corporate performance, and climate change, while the third section discusses the methodological procedures employed, followed by the analysis and discussion of the results in the fourth section and, finally, the final considerations.

2. Theoretical Framework

2.1. Corporate Practices of Mitigation and Adaptation to Climate Change

Adaptation and mitigation are considered two critical corporate responses to climate change and its impacts on the ecosystem, and in climate change management, these concepts can be perceived under different approaches [14]. Because of their different objectives, scales, planning, and implementation measures, mitigation and adaptation measures are treated separately in projects and policies [15–17].

Despite the differences in the concepts of adaptation and mitigation, the synergy and mutuality between them cannot be ruled out [16]. Berry et al. [18] corroborate by stating that synergies and conflicts between adaptation and mitigation are often ignored in research, and in the literature, there is a range of studies addressing the themes of mitigation and adaptation [17,19–22]. Nevertheless, few papers have presented a definition of the terms, and even fewer have applied the terms simultaneously. In this sense and to deepen these concepts, Table 1 lists the discrepancies in these definitions in the literature.

Table 1. Conceptualization of terms.

	Concept	Author
Mitigation	Technological changes and substitutions that reduce resource use and emissions per unit of production and implement measures that reduce greenhouse gas emissions and increase carbon sinks.	[23]
	Mitigation is a reduction in the rise of atmospheric greenhouse gases occurring via emission reductions or carbon sequestration.	[24]
	Global mitigation refers to reducing greenhouse gas emissions and/or enhancing carbon sinks.	[16,17]
	Mitigation options are available in all major sectors. They can be more cost-effective when used in an integrated approach that combines measures to reduce energy use and greenhouse gas end-use intensity, decarbonize energy supply, reduce net emissions, and enhance carbon sinks.	[25]
Adaptation	Initiatives and measures to reduce the vulnerability of natural and human systems against the current and expected effects of climate change.	[23]
	Adaptation can be defined as the set of actions taken in response to changes in climate, which improve well-being, do not change the climate as the goal, and would not have been done if the climate were not changing.	[24]
	Adaptation involves improving adaptive capacity and reducing vulnerability to climate change by taking advantage of favorable opportunities resulting from climate change.	[16]
	Adaptation options exist in all sectors, but the contexts for implementation and the potential to reduce climate-related risks differ across sectors and regions. Some adaptation responses involve co-benefits, synergies, and trade-offs. As climate change increases, so will the challenges for many adaptation options.	[25]

Source: Prepared by the authors.

According to the definitions above, mitigation is directly related to GHG reduction, and adaptation involves reducing vulnerability to climate change. Despite being perceived as two independent actions within science, their interaction is fundamental and must be addressed in all sectors [18]. The two concepts are inherently linked; for instance, a high mitigation level could require less adaptation, and conversely, with sufficient adaptation, is a possible reduction in the need for mitigation [26].

The model of mitigation practices used by Cadez and Czerny [27] involves a series of actions under different strategies related to emission reduction. Carbon-intensive companies focus on a single mitigation strategy rather than deploying multiple strategies simultaneously, and typically these strategies involve efficiency improvement practices that do not require high investments [27]. Moreover, studies have shown that achieving an absolute reduction in industrial emissions requires a broad set of mitigation options that go beyond common practices [28]. These primary mitigation practices that industrial companies can adopt are described and proposed by the IPCC [25], being: energy efficiency, emission efficiency (e.g., fuel and feedstock switching, carbon dioxide capture and storage), efficiency (e.g., reduced yield losses in production), reuse of materials and recycling of more intensive products, and increased product use and reduced demand for product services.

Strategies employed by industrial companies also include the use of technology, such as emission-free lighting, green buildings, non-greenhouse inputs (e.g., gases), environmentally friendly boilers, cooling systems, and cleaning agents [29,30]. In this sense, the importance and prominence of technology in mitigation practices are perceived, and industrial companies can employ a plethora of heterogeneous mitigation technologies, including pollution control, eco-efficiency, eco-design, and low-carbon energy management systems; an appropriate combination of technologies is also recommended to achieve the desired operational and environmental performance [31].

In the context of emissions, companies can implement corporate carbon strategies that encompass organizational engagement, risk management, carbon measurement and

policy, product improvements, process improvements, and carbon offsetting. Carbon competitiveness is summarized as organizational activities aimed at retaining or gaining a competitive advantage and covers issues such as new markets and products [32]. Mitigation measures are associated with adaptive actions in response to climate change by society and business [33], and there are significant analytical challenges associated with mitigation and adaptation assessments. However, the boundaries of mitigation measures are more clearly defined because there is a straightforward metric (GHG emission reduction) to assess the effectiveness of such determinations. Nonetheless, what does or does not fall within the scope of adaptation is much more ambiguous, and there are no widely accepted metrics for assessing the effectiveness of adaptation policies and measures.

By directing the gaze to managers, awareness of the climate effects that are responsible for the social and long-term implications of climate change stimulates a more comprehensive assessment of exposure to climate risks [34]. According to the authors, recognizing that organizational systems, management structures, or organizational policies can favor the adoption of a present-time perspective, stifling the understanding of the long-term implications of sustainability issues, emerges as a primary concern for companies that wish to encourage more proactive action on climate issues.

Adaptation strategies are often seen and linked as the responsibility of the government and the public sector. The private sector's primary thrust in the climate change field, so far, has been limited to issues involving mitigation strategies, including the monetization of carbon credits [30]. Nevertheless, it is pivotal for these agents to partake in climate change initiatives with a particular focus on adaptation. According to a United Nations report [35], adaptive measures should consider both preventive and corrective measures and avoid extreme and irreversible damage. Hence, it is possible to protect the most vulnerable sectors of the region's population and natural assets along with actions that will bring a range of additional benefits (improved health, welfare, and energy efficiency and reduced air pollution and deforestation). West and Brereton [33] highlighted several examples of adaptation measures that include installing and updating dams and rising sea level projections, which are taken into account in land management and coastal infrastructure and development policies; investing in climate protection in building infrastructure; developing integrated risk assessment tools in the insurance sector; and investing in drought prevention measures.

Adaptation options seem to have a complexity and dependence on the adaptation objective of each sector or environment. In this perspective, Rao and Thamizhvanan [30] reported that adaptation practices are usually specific to local conditions and developed locally from relevant action plans to reduce climate-related risks. These action plans involve information-sharing practices, developing early warning systems (to alert about impending calamities) and preparation plans, and developing strains and cultures that can withstand various climatic conditions (heatwaves, droughts, and water salinity).

The Brazilian Ministry of the Environment [36] developed the National Plan for Adaptation to Climate Change, with sectoral adaptation actions. According to this plan, adaptation actions for the industrial and mining sectors involve mapping risk areas, providing tools to access network data, monitoring and alerts using a managerial language, investing in ecosystem services (including "climate risks" assessments in all industrial companies' action plans), and investments in reuse and recycling, desalination, and alternative sources of obtaining water and energy.

2.2. Business Performance and Climate Change

A scenario characterized by the uncertainties and consequences of climate events brings forth numerous challenges to companies due to the loss or gains of tangible and intangible resources that this environment represents. Adopting sustainable practices in the context of climate change can influence their position in the market through corporate reputation and market legitimacy [37]. For companies with international operations, this issue is even more emerging. Chakrabarty and Wang [38] noted that these companies

face the most diverse expectations from their stakeholders, and adopting climate change mitigation and adaptation practices can thus influence export performance under the aspects of product leadership, sales, and technological evolution.

In a market context, Ziegler, Busch, and Hoffmann [39] evaluated the relationship between disclosed corporate responses to climate change and stock market performance and found that investors tend to invest in companies with a higher level of climate change disclosure, which may increase awareness of global warming. From another perspective, Cooper, Raman, and Yin [40] demonstrated the effects of GHG emissions on company value, reporting that there is a double price to pay associated with GHG emissions and related to a discount on company value, which is linked to the future negative cash flow associated with emissions and the reduced reputation of corporate social responsibility.

The vulnerability of production processes to natural disasters amplified by climate change can significantly hinder industrial companies' profits and market efficiency [41]. This is corroborated by Qian, Suryani, and Xing [42], who sought to explore the relationship between carbon policy performance and market returns at different times and policy changes. The authors showed that the market rewarded top carbon performers and penalized heavy polluters in energy-intensive industrial companies when reacting to the carbon tax repeal. Adopting environmental practices causes positive stakeholder perceptions and, consequently, improves these companies' image and reputation performance [43]. Hsu and Wang [44] found that investors appear to be concerned that the costs of combating global warming may outweigh the benefits.

Despite the controversy of a business perspective in science, companies may attempt to take advantage of possible economic opportunities arising from the climate issue by risks and costs, anticipating regulations and developing capabilities through new products or markets [44]. Thus, a perceived threat in the context of climate change can also be an encouraging factor for companies seeking an innovative solution. In addition to threats to their own operations, by adopting climate change adaptation strategies, companies also contribute to their role in society [45].

Reduced GHG emissions can bring different strategic benefits to companies [46], and several of these benefits include operational improvements, anticipating and influencing climate change regulations, accessing new sources of capital, improving risk management, improving reputation, identifying new market opportunities, and improving human resource management. Furthermore, studies have shown the impact of business activities on the environment and how the control of GHG emissions can reduce costs and generate a series of benefits for organizations [47].

In addition to the points described above, climate change can bring important consequences when considering companies' international operations. Through an empirical study, Chakrabarty and Wang [38] proved that multinational companies that implement climate change mitigation practices tend to significantly increase sales effectiveness and product leadership and achieve convergence between two strategic objectives: mitigating their impact on the climate and increasing competitiveness. For the authors, in addition to the direct influence of climate change mitigation on the competitiveness of multinational corporations, the level of internationalization of companies also acts as an essential control variable.

Given the context presented, the following research hypotheses were elaborated:

H1. *Climate change mitigation practices are positively associated with business performance.*

H2. *Climate change adaptation practices are positively associated with business performance.*

3. Methodology

This study adopted a sample of Brazilian companies from the industrial sector linked to the Carbon Disclosure Project (CDP), a non-profit organization that assists in managing the environmental impacts of cities, states, and companies [48]. The CDP consists of national and multinational industrial companies with potential impacts at the local and

global levels and high representativeness in the Brazilian economy. The CDP has one hundred and fifty-six (156) participating companies, albeit only the associated industrial companies were considered, totaling sixty-eight (68).

The data were collected through an e-survey using a five-point Likert scale. The respondents answered the questions by choosing scores that best reflected their opinion, with 1 being the lowest level of agreement and 5 the highest, whose tests proved to be the most appropriate choice for this research. Experts evaluated the initial version of the questionnaire, and a pre-test was then conducted with two random organizations from the sample that were asked to provide feedback on the clarity, comprehensiveness, adequacy, face validity, and readability of the items of the scales.

The studies of IPCC [25], Damert, Paul, and Baumgartner [32], MMA [36], West and Brereton [33], and Cadez and Czerny [27] were used to build the model and measure the mitigation and adaptation practices (independent variables) adopted in the face of climate change. The indicators of the independent variables are listed in Table 2.

Table 2. Variables and indicators of mitigation and adaptation practices.

Variables	Indicators	Theoretical Basis
Mitigation practices	Improving equipment, product, and technology efficiency; Cleaner low-carbon energy generation; Establishing an energy efficiency policy; Collaborative activities between companies in the sector, government, and other companies and organizations; Reuse of materials and recycling; Waste reduction; Reuse, recycling, and energy recovery; New industrial processes and radical product innovations; Product/service efficiency; Disclosing climate change reports (data on emissions and practices).	[25,27,32,33]
Adaptation practices	Mapping of risks related to climate change; Inclusion of climate risk in the company's action plans; Actions to reuse and/or desalinate water; Obtaining energy and water from alternative sources; Actions for ecosystem conservation.	[36]

Source: Prepared by the authors.

The dependent variables were characterized by business performance and represented by financial, innovative, production, market, and export performance. In this sense, the business performance construct was built considering the studies of Papadopoulos and Martín [49]; Gunday, Ulosoy, Kilic, and Alpkan [50]; and Kneipp [51], as shown in Table 3.

Table 3. Variables and indicators of business performance.

Variables	Indicators	Theoretical Basis
Financial performance	Return on assets (profit/total assets); Overall company profitability; Return on sales (profit/total sales); Cash flow (excluding investments).	[49–51]
Innovative performance	Cash flow (excluding investments); Innovations introduced in work processes and methods; Quality of the new products and services; Number of new projects in products and services; Percentage of new products in the existing portfolio; Number of innovations under intellectual property protection.	
Production performance	Production flexibility (volume); Production and delivery speed; Cost of production; Quality and compliance.	
Market performance	Total sales; Market share; Customer satisfaction.	
Export performance	Support received to enter the export market; Actions to increase the social and environmental awareness of the products/company; Mechanisms of response to competitor pressure; Improvements brought about from expansion into foreign markets; Increase in company profitability; Impacts from customer/consumer diversification; Increased supply in the product portfolio; Export sales; Export profitability.	

Source: Prepared by the authors.

Sixty-eight (68) industrial companies participating in the CDP were contacted. Of the companies contacted, 40 replied and agreed to participate, representing an average return rate of 58.8%. More than 54% of the respondents were coordinators, consultants, supervisor engineers, analysts, managers, environmental directors, or sustainability directors. The remaining respondents are active in administrative management positions and innovation. Regarding the companies' fields of activity, 17.1% were from the agricultural/agro-industrial sector; 11.4% from the energy sector; 8.6% each from the cellulose paper, chemical/petrochemical, pharmaceutical, and plastic sectors, respectively; 5.7% each from the rubber and machinery and equipment branches, respectively; 2.9% each from the metal/steel, ceramics, and footwear branches, respectively; and, lastly, 8.6% from other areas. For the purposes of comparison with the reality in the country, agribusiness is responsible for more than 26% of Brazil's GDP, while the industrial sector holds 22.2% of the Gross Domestic Product, with the electricity and gas sectors (9.8%), food (8.2%), construction of buildings (7.1%), and the extraction of oil and natural gas (6.6%) being the most representative. Regarding the size of Brazilian industries, 93.8% are micro and small, 5% are medium-sized companies, and 1.2% are large companies [52].

The non-adherence of the data distribution to normality was performed using the K-S test and the basis to choose the analysis techniques used in SPSS software (version 18.0). Univariate (means and standard deviation) and bivariate (correlation and multiple correspondence analysis) techniques were applied to analyze the existing relationship between mitigation and adaptation practices and climate change and business performance.

Due to the non-normality of the data, Spearman's r coefficient (rs) was used to analyze the bivariate correlation [53]. For the multiple correspondence analysis, homogeneity analysis (Homals) was adopted, which, through the perceptual maps, allowed the correspondences between the categories of variables studied to be viewed and evaluated according to their proximity [54].

4. Results and Discussion

The results were first analyzed by descriptive analysis and then analyzed by correlation and multiple correspondence analysis. Finally, the results are discussed theoretically.

4.1. Descriptive Analysis

In order to understand the average adoption of corporate practices in the selected sample, the two constructs were analyzed by univariate descriptive analysis. The first one refers to mitigation practices and the second to adaptation practices in climate change. The descriptive analyses of the mitigation practices adopted by the sample companies are listed in Table 4.

Table 4. Climate change mitigation practices of the analyzed companies.

	Mitigation Practices	Mean	Standard Deviation
Energy efficiency and emission efficiency	The company has practices to improve equipment, products, and technology efficiency.	4.15	1.16
	The company has cleaner, low-carbon energy generation practices (e.g., fossil fuel switching).	3.40	1.38
	The company has practices establishing an energy efficiency policy, such as combined heat and power and process changes and optimization.	3.39	1.32
	The company has practices of collaborative activities between companies in its sector and others.	2.55	1.41
Reuse and recycling	The company has practices for reusing materials and recycling products, including recycled materials.	3.95	1.21
	The company has waste reduction practices.	4.37	1.00
	The company has reuse, recycling, and energy recovery practices, such as material substitution.	3.43	1.39
Product/process improvements	The company has practices of new industrial processes, radical product innovations, and designs, including product changes, aimed at process efficiency and lower input usage.	3.59	1.32
	The company has product/service efficiency practices (e.g., overall end-use energy efficiency).	3.15	1.39
	The company has practices of releasing reports related to climate change (emission data and practices).	3.34	1.71

Source: Prepared by the authors.

According to the results, among the mitigation practices, the ones with the highest average scores involve reuse and recycling actions, making the practices of waste reduction, material reuse, and product recycling stand out. These findings are relevant as the IPCC [25] emphasized that one of the most effective ways of mitigating GHG emissions involves waste management and recycling. Moreover, the IPCC [25] states that industrial companies can improve their resource efficiency by recycling or reusing before sending materials to landfills, which are considered significant GHG emission sources. Several mitigation options exist at the pre-consumer stage, and the most important is waste reduction during production processes and the importance of post-consumer waste.

According to Cadez and Czerny [27], recycling materials are widely used in steel, aluminum, glass, and plastic industrial companies. Nevertheless, with over 158 companies from three European Union countries, the authors found that recycling practices are less applied than the other mitigation practices. In contrast to the information reported by Cadez and Czerny [27], the data herein demonstrate that industrial companies seem to be keener on adopting recycling and reuse practices compared to other mitigation actions, and this was also observed by Fuchs et al. [55], who showed recycling as one of the most adopted actions in reducing GHG emissions in the Brazilian automotive and pulp and paper sectors. The results found seem to be in line with Rao and Thamizhvanan [30], in which there was a greater interest of executives to participate or support in the context of mitigation strategies such as reduction, reuse, and recycling practices.

Still within the scope of mitigation practices, those related to energy efficiency and emissions efficiency stand out, as also noted by Kneipp [51], who showed that Brazilian industrial companies adopt, with high intensity, practices to improve energy efficiency and reduce emissions, demonstrating that they are concerned with the best use of natural resources. However, the practices representing the lowest adoption percentages refer to collaborative activities between companies and involvement in negotiations with governments and partnerships. This result does not follow the theories of Wadin, Ahlgren, and Bengtsson [56] and Berry et al. [18], who believed that alliances between differently sized companies and sectors are pivotal in the scope of mitigation and adaptation practices as they favor learning and spreading sustainable technologies, thereby contributing to sustainably transforming markets.

Given this scenario, the institutional reflection of these issues is fundamental since developing partnerships and establishing dialogue and cooperation with governments, organizations, and other stakeholders are essential for the efficiency of climate change coping plans in industrial companies [57,58], especially in developing countries [59]. In the scope of adaptation practices adopted by industrial companies, a similar index to mitigation practices is perceived, as presented in Table 5.

Table 5. Climate change adaptation practices of the analyzed companies.

Adaptation Practices	Mean	Standard Deviation
The company carries out risk mapping for climate change.	2.84	1.64
The company includes "climate risk" in its action plans.	3.05	1.60
The company has actions for the reuse and/or desalination of water.	3.75	1.32
The company has actions to obtain energy and water from alternative sources (e.g., wind, solar, geothermal, biomass, biogas, etc.).	3.16	1.59
The company has actions for ecosystem conservation.	4.00	1.34

Source: Prepared by the authors.

As illustrated above, the adaptation practice that presents the highest average is developing actions for ecosystem conversation. In a way, it is also perceived as a contradictory fact if we consider the study by Berry et al. [18], for which adaptation actions regarding ecosystem conservation, such as biodiversity and water, had a strong dependence on the interaction between sectors and organizations. This study identified that companies have a high index of ecosystem conservation practices, albeit, as seen earlier, they do not have collaborative activities between companies in the sector and across sectors.

The adaptation practice with the lowest average is mapping climate change risks, showing that companies may still struggle to identify and manage climate change risks. However, identifying and assessing the risks and impacts of climate change in organizations is the determining factor in climate policies [60,61]. Moreover, Gasbarro, Iraldo, and Daddi [13] reported that risk assessment helps determine and prioritize vulnerabilities and opportunities and may encourage companies to pay more attention to climate events. Hence, the absence of this practice in companies can maximize the impacts of climate change.

Considering these pieces of evidence, Brazilian industrial companies have an average level of adopting mitigation and adaptation practices related to climate change, corroborating Souza et al. [62], in which over half of the companies surveyed adopted mitigation plans, and 32% adopted adaptation plans. In this sense, our findings can be considered positive since these practices may be related to the more significant awareness and responsibility of the sampled companies towards environmental and climate issues. For Damert and Baumgartner [63], larger companies tend to implement more sophisticated measures in response to climate change, and this is likely because of their greater public exposure and superior financial and human resources. In this scenario, and considering that the sampled companies are large and references in the market, there are still challenges to maximizing mitigation and adaptation practices in Brazilian industrial companies.

Added to this context is the geographical importance of Brazil, considered highly vulnerable to climate change due to various factors, including its dependence on natural resources, the scale of its agricultural activities, the size of its forests, and its biodiversity [34]. Therefore, this issue requires an even more solid and focused attitude from companies and society towards minimizing climate change.

4.2. Correlation and Multiple Correspondence Analysis

The association between climate change mitigation and adaptation practices and business performance was carried out by correlation analysis between the indicators of the independent and dependent variables considering the mean of each construct (Table 6).

Table 6. Climate change adaptation and mitigation practices and corporate performance—Spearman's correlation.

		Financial Performance	Innovative Performance	Production Performance	Market Performance	Export Performance
Mitigation practices	Improving equipment, product, and technology efficiency.	0.231	0.408 *	0.349	0.252	0.266
	Cleaner, low-carbon energy generation.	0.058	0.078	0.242	0.012	0.318
	Establishing an energy efficiency policy.	0.181	0.244	0.291	0.020	0.316
	Collaborative activities between companies in the sector, government, and other companies and organizations.	0.057	0.070	0.290	0.022	0.390 *
	Reuse of materials and recycling.	0.247	0.122	0.253	0.122	0.056
	Waste reduction.	0.027	0.100	0.234	0.287	0.143
	Reuse, recycling, and energy recovery.	0.103	0.241	0.219	0.169	0.448 **
	New industrial processes and radical product innovations.	0.077	0.186	0.472 *	0.229	0.208
	Product/service efficiency.	0.047	0.320	0.242	0.171	0.346
	Disclosure of climate change-related reports (emission data and practices).	0.329	0.492 **	0.621 **	0.280	0.581 **

Table 6. *Cont.*

		Financial Performance	Innovative Performance	Production Performance	Market Performance	Export Performance
Adaptation practices	Mapping the risks related to climate change.	0.091	0.098	0.159	0.265	0.420 *
	Including climate risk in the company's action plans.	0.091	0.269	0.380	0.178	0.388 *
	Actions for water reuse and/or desalination.	0.089	0.131	0.260	0.323	0.400 *
	Obtaining energy and water from alternative sources.	0.139	0.076	0.400 *	0.012	0.319
	Actions for ecosystem conservation.	0.289	0.407 *	0.535 **	0.181	0.172

Note 1: * Significant positive correlations ($p \leq 0.01$). Note 2: ** Significant positive correlations ($p \leq 0.05$). Source: Prepared by the authors.

In the context of climate change mitigation practices, improving equipment, product, and technology efficiency was significantly correlated with innovative performance (rs = 0.408; $p < 0.01$). Furthermore, collaborative activities between companies in the sector, government, and other companies and organizations were significantly correlated with export performance (rs = 0.390; $p < 0.01$), and the practice of reuse, recycling, and energy recovery had significant correlations with export performance (rs = 0.448; $p < 0.05$). New industrial processes and radical product innovations showed significant correlations with export performance (rs = 0.472; $p < 0.05$) and the disclosure of climate change-related reports (emission data and practices) showed positive and significant correlations with innovative performance (rs = 0.492; $p < 0.05$), production performance (rs = 0.621; $p < 0.05$), and export performance (rs = 0.581; $p < 0.05$).

In the analyses of climate change adaptation practices, export performance showed positive and significant correlations with climate change-related risk mapping practices (rs = 0.420; $p < 0.01$), the inclusion of climate risk in company action plans (rs = 0.388; $p < 0.01$), and water reuse and/or desalination actions (rs = 0.400; $p < 0.01$). The practice of obtaining energy and water from alternative sources showed positive and significant correlations with production performance (rs = 0.400; $p < 0.01$), and actions for ecosystem conservation positively and significantly correlated with innovative performance (rs = 0.407; $p < 0.01$) and production performance (rs = 0.535; $p < 0.05$).

In order to confirm the bilaterality of the relationship between mitigation and adaptation practices and business performance, multiple correspondence analysis (Homals) was carried out. For this analysis, the different dimensions of business performance and the variables corresponding to mitigation and adaptation practices were used as variables, thus enabling the existence of the relationships. The new variables generated were divided into three categories of analysis (Table 7).

Table 7. Multiple correspondence analysis—Homals.

Constructs		Indicators
Corporate practices	Mitigation practices Adaptation practices	High adoption degree Low adoption degree
Business performance	Financial performance Innovative performance Production performance Market performance Export performance	High Medium Low

Source: Prepared by the authors.

The analyses showed that dimension 1 has an eigenvalue of 0.484714 and dimension 2 a value of 0.275000. The eigenvalues demonstrate the contribution of each dimension

and reveal the variability in the data [53]. Some inferences in the scope of the management of climate change management and its interface with business performance in Brazilian industrial companies are plotted in Figure 1.

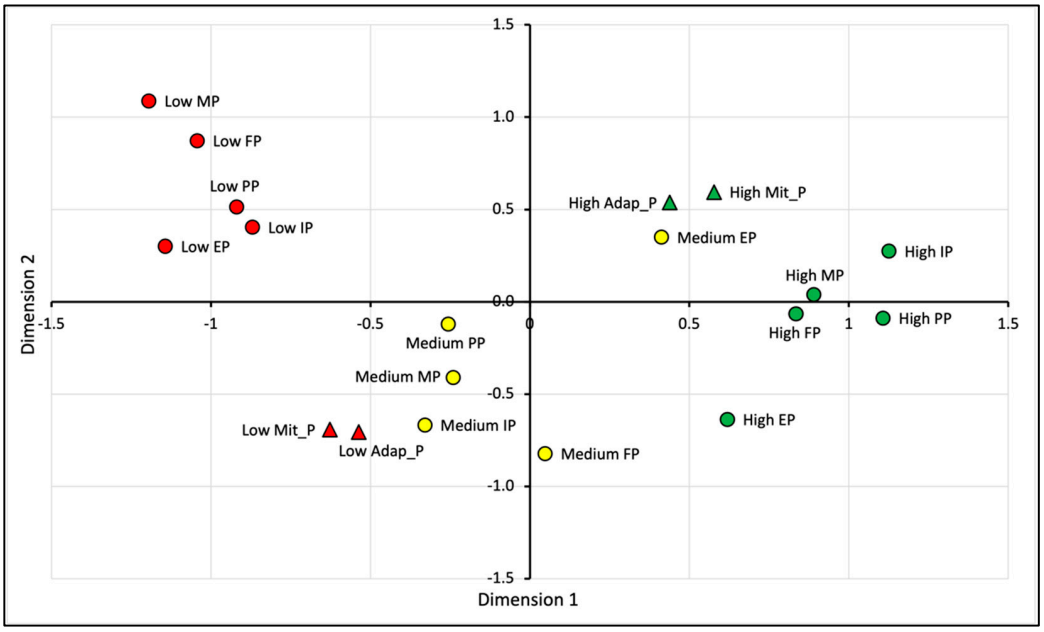

Figure 1. Multiple correspondence analysis—Homals. Note: Financial performance (FP); innovative performance (IP); production performance (PP); market performance (MP); export performance (EP); mitigation practices (Mit_P); adaptation practices (Adap_P). Source: Prepared by the authors.

The results allow us to determine the degrees of business performance (high, medium, and low).

- The high adoption degree of mitigation practices is correlated with high innovative performance.
- The high adoption degree of mitigation practices is correlated with high market performance.
- The high adoption degree of mitigation and adaptation practices is correlated with medium export performance.
- The low adoption degree of mitigation and adaptation practices is correlated with medium innovation, production, and market performance.

Given the analyses performed, industrial companies that adopt mitigation and adaptation practices with high intensity have a high degree of innovative performance. Similarly, companies with a high degree of mitigation and adaptation practices have a high market performance. The results found in the correlation and multiple correspondence analyses confirm our findings of the exploratory analysis and underline the importance of industrial companies adopting mitigation and adaptation practices to gain a competitive advantage in the market and innovations sphere. In the next section, the results are discussed theoretically.

4.3. Discussion

The evidence of the analyses corroborates the theoretical findings of Bandeira, Góis, Luca, and Vasconcelos [64], since a higher level of disclosure and knowledge of GHG emissions can affect the stakeholders' perception, thus influencing the purchasing and reputation processes and consequently indirectly leading to financial gains. Therefore, it is believed that despite it not being possible to view this direct relationship between mitigation and adaptation practices and financial performance, there is a consequent impact

of higher market, innovation, and export performance since these are important variables for the profitability of companies [65].

As well as Damert, Paul, and Baumgartner [32] and Damert and Baumgartner [63], this study did not identify an association between carbon mitigation practices and the financial performance of the analyzed companies. The importance of the study context is highlighted, since, for Seles et al. [9], there is a weakening of the relationship between environmental practices and business performance in Brazil, as a consequence of the economic crisis experienced in the country. Although it is not possible to link practices related to climate change and business performance, it appears that, in the long term, consequently, such measures may be associated with financial gains or losses. In this sense, implementing adaptation processes is important in economic terms, in the sense that it contributes to reducing higher costs resulting from climate change [34].

Furthermore, some climate change mitigation and adaptation practices are positively associated with innovative performance, and this corroborates the data presented by Martinez-Conesa, Soto-Acosta, and Palacios-Manzano [66] in the sense that, as companies adopt sustainable practices, there is higher innovative performance. Such evidence also finds theoretical consistency with Rodima-Taylor, Olwig, and Chhetri [67], who stated that a context of climate change requires organizations to have higher innovative and technological performance. In contrast to what Damert, Paul, and Baumgartner [32] and Damert and Baumgartner [63] reported, our study did not identify strong positive associations between mitigation and adaptation practices and financial performance. Notably, the data herein is crucial since, as Seles et al. [9] emphasized, there is a weakening of the relationships between environmental practices and business performance in Brazil due to the economic crisis in the country.

The influence of climate change on developing innovations, technologies, and services is evident since most mitigation and adaptation practices require developing and applying technologies and new products to achieve operational efficiency [67–70]. In fact, the correlation between improved equipment, product, technology efficiency, and business performance is evident, reinforcing the interrelation of the themes and validating the theoretical assumptions of Stefano, Montes-Sancho, and Busch [71], since, in order to reduce GHG emissions, companies have increasingly sought to develop significant innovations, whether in the form of products, processes, or technologies. The results confirm the data of Seles et al. [9] and testify that among environmental practices, those related to technology and environmental innovations tended to represent an improvement in business performance.

In addition, we highlight the bilaterality of the themes since, besides the dependence on innovation already addressed in the literature, companies that invest heavily in mitigation and adaptation practices achieve superior innovative performance. This information can be of great value for companies and contribute to implementing and disseminating these practices since companies' gains transcend financial aspects [72,73]. What is more, these data point out that actions to control GHG emissions may lead to productivity gains, thus corroborating Cucchiella, Gastaldi, and Miliacca [47,74]. Radhouane, Nekhili, Nagati, and Pache [75] also found that companies that disclose environmental actions are positively related to business performance (i.e., higher environmental disclosure is valuable in terms of market performance).

Furthermore, the multiple correspondence analysis (Homals) showed that adopting mitigation practices can be important in terms of market performance, therefore consolidating the findings of Qian, Suryani, and Xing [42]; Cooper, Raman, and Yin [40]; Jorge et al. [43]; and Ziegler et al. [39] and reinforcing the macro-environmental attention that companies must have with climate issues. It was also possible to identify a relationship between practices related to climate change and export performance, collaborating with the study of Chakrabarty and Wang [38]. This relationship is interesting at the foreign market level because companies concerned with climate change mitigation and adaptation actions may be standing out due to factors already evidenced by McWilliams and Siegel [76], such

as product differentiation, differentiated consumer vision, and awareness of sustainability issues in international markets.

Therefore, it is possible to sustain that those corporate practices of the mitigation of climate change are positively correlated with business performance (H1). Similarly, it was also possible to elucidate that corporate climate change adaptation practices are positively correlated with business performance (H2).

5. Conclusions

This study aimed to understand the behavior of Brazilian industrial companies in the context of climate change and verify how mitigation and adaptation practices relate to business performance. Our findings made it possible to understand and present evidence of the behavior of companies in terms of positioning and practices in the context of climate change and the relationship with business performance. Hence, it was possible to identify, theoretically and empirically, important and guiding elements for advancing this area of knowledge.

According to the results, Brazilian industrial companies have been adopting both corporate practices of mitigation and adaptation to climate change. Waste reduction is the practice with the highest average adoption in the mitigation area, while for adaptation practices, there is a greater propensity for ecosystem conservation practices. Nevertheless, the mitigation practice with the lowest adoption refers to collaborative activities involving other companies, while the lowest adaptation adoption practice refers to mapping risks related to climate change. In general, considering the overall means, a moderate level of adoption of climate change practices by Brazilian industrial companies was observed. Given that the sample was characterized by large companies that are consolidated in the market and active in the international scenario, these results imply that joint efforts are still required to deal with the current effects of climate change and future projections of uncertainties involving this concerning scenario.

Through the bivariate correlation and multiple correspondence analysis techniques, it was possible to identify the possible relationships between mitigation and adaptation practices and different dimensions of business performance. Moreover, we elucidated that industrial companies that adopt mitigation and adaptation practices with high intensity have a high degree of innovative performance. Similarly, companies with a high degree of mitigation and adaptation practices have a high market performance. This manuscript also contributes to scientific advancement, as there are still numerous uncertainties and controversial studies involving the theme. Developing a model that addresses the management of practices related to climate change and business performance in an integrated way can be considered a theoretical contribution because, in the literature, there are initiatives that deal unilaterally, and there is still a lack of empirical studies on these themes.

Although this study broadens the knowledge about companies' responses to climate change, significant limitations are considered. The first limitation refers to the sample size since there was a low response rate; thus, the results cannot be generalized to the other companies in the research universe, restricting them only to the sample as a whole. Another limitation refers to the theoretical choices because the theme is still incipient in administrative science, and, finally, the fact that the corporate information is based on the individual perceptions of a single respondent.

This study allows some suggestions for future research. One of the suggestions is expanding the sample universe, allowing the verification of the influence of the segment, international performance, and the size in the positioning of companies concerning climate issues. In addition, this study only focused on industrial companies, although it would also be interesting to shed light on companies from other sectors (i.e., services), thus revealing possible divergences and synergies between the sectors.

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I.K.; writing—original draft preparation, A.P.P.; writing—review and editing, C.M.G. and F.D.M.; visualization, A.P.P.; supervision, C.M.G. and I.K.; project administration, A.P.P.; funding acquisition, C.M.G. All authors have read and agreed to the published version of the manuscript.

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References

1. Rifkin, D.I.; Long, M.W.; Perry, M.J. Climate Change and Sleep: A Systematic Review of The Literature and Conceptual Framework. *Sleep Med. Rev.* **2018**, *42*, 3–9. [CrossRef] [PubMed]
2. Eekhout, J.P.C.; de Vente, J. Assessing the Effectiveness of Sustainable Land Management for Large-Scale Climate Change Ad-Aptation. *Sci. Total Environ.* **2018**, *654*, 85–93. [CrossRef]
3. Chen, Y.; Liu, A.; Cheng, X. Quantifying Economic Impacts of Climate Change Under Nine Future Emission Scenarios Within CMIP6. *Sci. Total Environ.* **2019**, *703*, 134950. [CrossRef]
4. IPCC. Summary for Policymakers. In *Global Warming of 1.5 °C. An IPCC Special Report on the Impacts of Global Warming of 1.5 °C Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty*; Masson-Delmotte, V., Zhai, P., Pörtner, H.-O., Roberts, D., Skea, J., Shukla, P.R., Pirani, A., Moufouma-Okia, W., Péan, C., Pidcock, R., et al., Eds.; World Meteorological Organization: Geneva, Switzerland, 2018; 32p.
5. Linnenluecke, M.K.; Griffiths, A.; Winn, M.I. Firm and Industry Adaptation to Climate Change: A Review of Climate Adaptation Studies in the Business and Management Field. *WIREs Clim. Chang.* **2013**, *4*, 397–416. [CrossRef]
6. Confederação Nacional das Indústrias—CNI. *Encontros CNI Sustentabilidade—2015*, 4th ed.; CNI: Rio de Janeiro, Brazil, 2015; Available online: https://static-cms-si.s3.amazonaws.com/media/filer_public/81/f8/81f8ad9d-8ef7-412d-b1f3-1bcd47094535/pesquisacnisustentabilidade.pdf (accessed on 20 January 2018).
7. Daddi, T.; Todaro, N.M.; Giacomo, M.R.; de Frey, M. A Systematic Review of the Use of Organization Andmanagement Theories in Climate Change Studies. *Bus. Strategy Environ.* **2018**, *27*, 456–474. [CrossRef]
8. Benites-Lazaro, L.L.; Gremaud, A.; Benites, L. Business Responsibility Regarding Climate Change in Latin America: An Empirical Analysis from Clean Development Mechanism (CDM) Project Developers. *Extr. Ind. Soc.* **2018**, *5*, 297–306. [CrossRef]
9. Seles, B.M.R.P.; Jabbour, A.B.L.D.S.; Jabbour, C.J.C.; Latan, H.; Roubaud, D. Do Environmental Practices Improve Business Performance Even in an Economic Crisis? Extending the Win-Win Perspective. *Ecol. Econ.* **2019**, *163*, 189–204. [CrossRef]
10. Chen, S.; Chen, X.; Xu, J. Impacts of Climate Change on Agriculture: Evidence from China. *J. Environ. Econ. Manag.* **2016**, *76*, 105–124. [CrossRef]
11. Stuecker, M.; Tigchelaar, M.; Kantar, M.B. Climate Variability Impacts on Rice Production in the Philippines. *PLoS ONE* **2018**, *13*, e0201426. [CrossRef]
12. Linnenluecke, M.K.; Zhou, C.; Smith, T.; Thompson, N.; Nucifora, N. The Impact of Climate Change on the Australian Sug-arcane Industry. *J. Clean. Prod.* **2020**, *246*, 118974. [CrossRef]
13. Gasbarro, F.; Iraldo, F.; Daddi, T. The Drivers of Multinational Enterprises' Climate Change Strategies: A Quantitative Study on Climate-Related Risks and Opportunities. *J. Clean. Prod.* **2017**, *160*, 8–26. [CrossRef]
14. Ayers, J.; Huq, S. Supporting Adaptation to Climate Change: What Role for Official Development Assistance? *Dev. Policy Rev.* **2009**, *27*, 675–692. [CrossRef]
15. Klein, R.J.; Schipper, E.L.F.; Dessai, S. Integrating Mitigation and Adaptation into Climate and Development Policy: Three Research Questions. *Environ. Sci. Policy* **2005**, *8*, 579–588. [CrossRef]
16. Duguma, L.A.; Minang, P.A.; Van Noordwijk, M. Climate Change Mitigation and Adaptation in the Land Use Sector: From Complementarity to Synergy. *Environ. Manag.* **2014**, *54*, 420–432. [CrossRef]
17. Kongsager, R.; Locatelli, B.; Chazarin, F. Addressing Climate Change Mitigation and Adaptation Together: A Global Assess-ment of Agriculture and Forestry Projects. *J. Environ. Manag.* **2016**, *57*, 271–282. [CrossRef] [PubMed]
18. Berry, P.M.; Brown, S.; Chen, M.; Kontogianni, A.; Rowlands, O.; Simpson, G.; Skourtos, M. Cross-Sectoral Interactions of Adaptation and Mitigation Measures. *Clim. Chang.* **2014**, *128*, 381–393. [CrossRef]
19. Gifford, R. The Dragons of Inaction: Psychological Barriers That Limit Climate Change Mitigation and Adaptation. *Am. Psychol.* **2011**, *66*, 290–302. [CrossRef]
20. Moser, S.C. Navigating the Political and Emotional Terrain of Adaptation: Community Engagement When Climate Change Comes Home. In *Successful Adaptation to Climate Change: Linking Science and Policy in a Rapidly Changing World*; Moser, S.C., Boykoff, M.T., Eds.; Routledge: London, UK, 2012; pp. 1–17.

21. Aguilera, E.; Lassaletta, L.; Gattinger, A.; Gimeno, B.S. Managing Soil Carbon for Climate Change Mitigation and Adaptation in Mediterranean Cropping Systems: A Meta-Analysis. *Agric. Ecosyst. Environ.* **2013**, *168*, 25–36. [CrossRef]
22. Lucena, A.F.; Hejazi, M.; Vasquez-Arroyo, E.; Turner, S.; Köberle, A.C.; Daenzer, K.; Rochedo, P.R.; Kober, T.; Cai, Y.; Beach, R.H.; et al. Interactions between Climate Change Mitigation and Adaptation: The Case of Hydropower in Brazil. *Energy* **2018**, *164*, 1161–1177. [CrossRef]
23. Brasil. Lei nº 12.187, de 29 de Dezembro de 2009. Brasília, 29 de Dezembro de 2009. Available online: http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2009/Lei/L12187.htm (accessed on 20 January 2018).
24. Felgenhauer, T.; Webster, M. Multiple Adaptation Types with Mitigation: A Framework for Policy Analysis. *Glob. Environ. Chang.* **2013**, *23*, 1556–1565. [CrossRef]
25. IPCC. Summary for Policymakers. In *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*; Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., Adler, A., Baum, I., Brunner, S., Eickemeier, P., et al., Eds.; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2014.
26. Wilbanks, T.J.; Leiby, P.; Perlack, R.; Ensminger, J.T.; Wright, S.B. Toward an Integrated Analysis of Mitigation and Adaptation: Some Preliminary Findings. *Mitig. Adapt. Strat. Glob. Chang.* **2007**, *12*, 713–725. [CrossRef]
27. Cadez, S.; Czerny, A. Climate Change Mitigation Strategies in Carbon-Intensive Firms. *J. Clean. Prod.* **2016**, *112*, 4132–4143. [CrossRef]
28. Fischedick, M.; Roy, J.; Abdel-aziz, A.; Acquaye, A.; Aallwood, J.M.; Ceron, J.-P.; Geng, Y.; Kheshgi, H.; Lanza, A.; Perczyk, D.; et al. Industry. In *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*; Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., Adler, A., Baum, I., Brunner, S., Eickemeier, P., et al., Eds.; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2014; pp. 739–810.
29. Halady, I.R.; Rao, P.H. Does Awareness to Climate Change Lead to Behavioral Change? *Int. J. Clim. Chang. Strategy Manag.* **2010**, *2*, 6–22. [CrossRef]
30. Rao, P.H.; Thamizhvanan, A. Impacts of Climate Change: Survey of Mitigation and Adaptation Strategies of Junior Corporate Executives in India. *Int. J. Clim. Chang. Strategy Manag.* **2014**, *6*, 401–420. [CrossRef]
31. Wang, D.D.; Li, S.; Sueyoshi, T. Determinants of Climate Change Mitigation Technology Portfolio: An Empirical Study of Major U.S. Firms. *J. Clean. Prod.* **2018**, *196*, 202–215. [CrossRef]
32. Damert, M.; Paul, A.; Baumgartner, R.J. Exploring the Determinants and Long-Term Performance Outcomes of Corporate Carbon Strategies. *J. Clean. Prod.* **2017**, *160*, 123–138. [CrossRef]
33. West, J.M.; Brereton, D. *Climate Change Adaptation in Industry and Business: A Framework for Best Practice in Financial Risk Assessment, Governance and Disclosure*; National Climate Change Adaptation Research Facility: Gold Coast, Australia, 2013; p. 144.
34. Todaro, N.M.; Testa, F.; Daddi, T.; Iraldo, F. The Influence of Managers' Awareness of Climate Change, Perceived Climate Risk Exposure and Risk Tolerance on Theadoption of Corporate Responses to Climate Change. *Bus. Strategy Environ.* **2021**, *30*, 1232–1248. [CrossRef]
35. United Nations. The economics of Climate Change in Latin America and the Caribbean Paradoxes and Challenges of Sustainable Development. 2015. Available online: https://repositorio.cepal.org/bitstream/handle/11362/37311/4/S1420655_en.pdf (accessed on 12 December 2019).
36. Ministério do Meio Ambiente. *Plano Nacional de Adaptação à Mudança do Clima: Estratégias Setoriais e Temáticas Ministério do Meio Ambiente*; MMA: Brasília, Brazil, 2016; Volume 2, p. 295.
37. Brammer, S.J.; Pavelin, S. Corporate Reputation and Social Performance: The Importance of Fit. *J. Manag. Stud.* **2006**, *43*, 435–455. [CrossRef]
38. Chakrabarty, S.; Wang, L. Climate Change Mitigation and Internationalization: The Competitiveness of Multinational Coporrations. *Thunderbird Int. Bus. Rev.* **2013**, *55*, 673–688. [CrossRef]
39. Ziegler, A.; Busch, T.; Hoffmann, V.H. Disclosed Corporate Responses to Climate Change and Stock Performance: An International Empirical Analysis. *Energy Econ.* **2011**, *33*, 1283–1294. [CrossRef]
40. Cooper, S.A.; Raman, K.; Yin, J. Halo Effect or Fallen Angel Effect? Firm Value Consequences of Greenhouse Gas Emissions and Reputation for Corporate Social Responsibility. *J. Account. Public Policy* **2018**, *37*, 226–240. [CrossRef]
41. Hong, H.; Li, F.W.; Xu, J. Climate Risks and Market Efficiency. *J. Econ.* **2018**, *208*, 265–281. [CrossRef]
42. Qian, W.; Suryani, A.W.; Xing, K. Does Carbon Performance Matter to Market Returns During Climate Policy Changes? Evidence from Australia. *J. Clean. Prod.* **2020**, *259*, 121040. [CrossRef]
43. Jorge, M.; Jesús, H.; Martínez-Martínez, D.; Sancho, M. Competitiveness and Environmental Performance in Spanish Small and Medium Enterprises: Is There a Direct Link? *J. Clean. Prod.* **2015**, *15*, 26–37. [CrossRef]
44. Hsu, A.W.; Wang, T. Does the Market Value Corporate Response to Climate Change? *Omega* **2013**, *41*, 195–206. [CrossRef]
45. Haney, A.B. Threat Interpretation and Innovation in the Context of Climate Change: An Ethical Perspective. *J. Bus. Ethics* **2015**, *143*, 261–276. [CrossRef]
46. Hoffman, A.J. Climate Change Strategy: The Business Logic behind Voluntary Greenhouse Gas Reductions. *Calif. Manag. Rev.* **2005**, *47*, 21–46. [CrossRef]

47. Cucchiella, F.; Gastaldi, M.; Miliacca, M. The Management of Greenhouse Gas Emissions and Its Effects on Firm Per-Formance. *J. Clean. Prod.* **2017**, *167*, 1387–1400. [CrossRef]
48. Carbon Disclosure Project (CDP Media Factsheet-2020). Available online: https://6fefcbb86e61af1b2fc4c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/comfy/cms/files/files/000/003/419/original/CDP-Media-Factsheet.pdf (accessed on 15 January 2020).
49. Papadopoulos, N.; Martín, M.O. Toward a Model of the Relationship between Internationalization and Export Performance. *Int. Bus. Rev.* **2010**, *19*, 388–406. [CrossRef]
50. Gunday, G.; Ulusoy, G.; Kilic, K.; Alpkan, L. Effects of Innovation Types on Firm Performance. *Int. J. Prod. Econ.* **2011**, *133*, 662–676. [CrossRef]
51. Kneipp, J.M. *Gestão Estratégica da Inovação Sustentável e sua Relação com o Modelo de Negócios e o Desempenho Empresarial. Tese (Doutorado em Administração), Universidade Federal de Santa Maria—UFSM*; Programa de Pós-Graduação: Santa Maria, Italy, 2016; 187p.
52. Confederação Nacional das Indústrias—CNI (Perfil da Indústria Brasileira-2020). Available online: https://industriabrasileira.portaldaindustria.com.br/grafico/total/producao/#/industria-total (accessed on 5 September 2022).
53. Pestana, M.H.; Gageiro, J.N. *Análise de Dados para Ciências Sociais: A Complementariedade do SPSS*, 5th ed.; Edições Silabo: Lisboa, Portugal, 2008.
54. Greenacre, M. Correspondence Analysis of Raw Data. *Ecology* **2010**, *91*, 958–963. [CrossRef] [PubMed]
55. Fuchs, P.G.; Macedo-Soares, T.D.L.; Russo, G. Modelo Conceitual Para Avaliação de Práticas e Estratégias Climáticas: Resultados de Sua Aplicação Nos Setores Automotivo e de Papel e Celulose no Brasil. *Rev. Adm. Pública* **2009**, *43*, 837–874. [CrossRef]
56. Wadin, J.L.; Ahlgren, K.; Bengtsson, L. Joint Business Model Innovation for Sustainable Transformation of Industries—A Large Multinational Utility in Alliance with a Small Solar Energy Company. *J. Clean. Prod.* **2017**, *160*, 139–150. [CrossRef]
57. Sprengel, D.C.; Busch, T. Stakeholder Engagement and Environmental Strategy—The Case of Climate Change. *Bus. Strat. Environ.* **2010**, *20*, 351–364. [CrossRef]
58. Hickmann, T. The Reconfiguration of Authority in Global Climate Governance. *Int. Stud. Rev.* **2017**, *19*, 430–451. [CrossRef]
59. Naudé, W. Climate Change and Industrial Policy. *Sustainability* **2011**, *3*, 1003–1021. [CrossRef]
60. Surminski, S.; Di Mauro, M.; Baglee, J.A.R.; Connell, R.K.; Hankinson, J.; Haworth, A.R.; Ingirige, B.; Proverbs, D. Assessing Climate Risks Across Different Business Sectors and Industries: An Investigation of Methodological Challenges at National Scale for the UK. *Philos. Trans. R. Soc. London Ser. A Math. Phys. Eng. Sci.* **2018**, *376*, 20170307. [CrossRef]
61. Aguinaldo, M.E.C.; Daddi, T.; Hamza, M.; Gasbarro, F. Climate Change Perspectives and Adaptation Strategies of Business Enterprises: A Case Study from Italy. *Int. J. Sustain. Dev. World Ecol.* **2018**, *26*, 129–140. [CrossRef]
62. Souza, A.L.R.; Faria, J.A.; Andrade, J.C.S.; Torres, R.C.S.R.; Gomes, S.M.S. Ações Empresariais para mitigação das Mudanças Climáticas no Brasil: Uma análise das empresas que fazem parte do Índice Carbono Eficiente (ICO2) e do Programa Brasileiro GHG Protocol. In *Encontro Internacional Sobre Gestão Empresarial E Meio Ambiente—Engema*; Anais São Paulo USP: São Paulo, Brazil, 2014; Volume 16, pp. 1–17.
63. Damert, M.; Baumgartner, R.J. Intra-Sectoral Differences in Climate Change Strategies: Evidence from the Global Auto-Motive Industry. *Bus. Strategy Environ.* **2018**, *27*, 265–281. [CrossRef]
64. Bandeira, M.T.S.S.; Góis, A.D.; Luca, M.M.M.; Vasconcelos, A.C. Reputação corporativa negativa e o Desempenho Empresarial. *Rev. Contab. E Organ.* **2015**, *9*, 71–83. [CrossRef]
65. Byukusenge, E.; Munene, J.C. Knowledge Management and Business Performance: Does Innovation Matter? *Cogent Bus. Manag.* **2017**, *4*, 1368434. [CrossRef]
66. Martinez-Conesa, I.; Soto-Acosta, P.; Palacios-Manzano, M. Corporate social Responsibility and Its Effect on Innovation and Firm Performance: An Empirical Research in SMEs. *J. Clean. Prod.* **2017**, *142*, 2374–2383. [CrossRef]
67. Rodima-Taylor, D.; Olwig, M.F.; Chhetri, N. Adaptation as Innovation, Innovation as Adaptation: An Institutional Approach to Climate Change. *Appl. Geogr.* **2012**, *33*, 107–111. [CrossRef]
68. Chhetri, N.B.; Easterling, W.E. Adapting to Climate Change: Retrospective Analysis of Climate Technology Interaction in the Rice-Based Farming System of Nepal. *Ann. Assoc. Am. Geogr.* **2010**, *100*, 1156–1176. [CrossRef]
69. Huisingh, D.; Zhang, Z.; Moore, J.; Qiao, Q.; Li, Q. Recent Advances in Carbono Emissions Reduction: Policies Tech-Nologies Monitoring, Assessment and Modeling. *J. Clean. Prod.* **2015**, *103*, 1–12. [CrossRef]
70. Adenle, A.A.; Azadi, H.; Arbiol, J. Global Assessment of Technological Innovation for Climate Change Adaptation and Mitigation in Developing World. *J. Environ. Manag.* **2015**, *161*, 261–275. [CrossRef]
71. De Stefano, M.C.; Montes-Sancho, M.J.; Busch, T. A Natural Resource-Based View of Climate Change: Innovation Challenges in the Automobile Industry. *J. Clean. Prod.* **2016**, *139*, 1436–1448. [CrossRef]
72. Lopes, L.C.; Siqueira, K.P.; Vieira, É.M.; Freitas, M.A. Adoção de Práticas de Controles Financeiros e Não Financeiros por Microempreendedores Individuais. *Rev. Eletrônica Gestão Soc.* **2014**, *8*, 749–766. [CrossRef]
73. Callado, A.L.C.; Callado, A.A.C.; Almeida, M.A. A Utilização de Indicadores de Desempenho Não-Financeiros em OrganiZações Agroindustriais: Um Estudo Exploratório. *Organ. Rurais Agroind.* **2008**, *10*, 35–48.
74. Ooi, S.K.; Goh, S.; Yeap, J.A.; Loo, K.S. Linking Corporate Climate Change and Financial Performance: Evidence from Malaysia. Glob. *J. Int. Bus. Res.* **2018**, *10*, 231–264.

75. Radhouane, I.; Nekhili, M.; Nagati, H.; Paché, G. The Impact of Corporate Environmental Reporting on Customer-Related Performance and Market Value. *Manag. Decis.* **2018**, *56*, 1630–1659. [CrossRef]
76. Mcwilliams, A.; Siegel, D.S. Creating and Capturing Value: Strategic Corporate Social Responsibility, Resource-Based Theory, And Sustainable Competitive Advantage. *J. Manag.* **2011**, *37*, 1480–1495. [CrossRef]