



## BUSINESS STRATEGIES FOR CLIMATE CHANGE OF WATER RESOURCES MANAGEMENT COMPANIES THAT ARE INTEGRATED TO THE CARBON DISCLOSURE PROJECT

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### Abstract

**Objective of the study:** To identify the strategic profiles regarding climate change of water resources management companies that are part of the Carbon Disclosure Project (CDP) database, for the year 2019.

**Methodology / approach:** An exploratory research was carried out using bibliographic and documentary research and multiple case studies. The data used come from the 2019 CDP database, analyzed according to the methodological structure of Kolk and Pinkse (2005). Data were analyzed using content analysis.

**Originality / Relevance:** The results of this research serve as an indication of the vulnerability and contribution of the segment in the maintenance and security of the supply of quality water in the medium and long term.

**Main results:** Most water resource management organizations, still in 2019, fit the profiles of Cautious Planners and Emerging Planners and have as main strategic drivers the perception of opportunities, risks, and corporate responsibility, in that order.

**Theoretical / methodological contribution:** As theoretical contributions, the work brings the analysis of organizational strategies, specifically of companies in the water resources area, aimed at mitigating climate change. The data analysis method adopted here can be used in other business segments that are directly related to natural resources.

**Social / management contributions:** The survey results can support decisions and changes in corporate strategies for mitigating greenhouse gas emissions in the water resources segment, as well as public policies for planning and coping with climate change.

**Keywords:** Strategic profile. Climate changes. Water resources management. Mitigation. Carbon Disclosure Project.

### ESTRATÉGIAS DE NEGÓCIO PARA MUDANÇAS CLIMÁTICAS DAS EMPRESAS DE GESTÃO DE RECURSOS HÍDRICOS INTEGRANTES DO CARBON DISCLOSURE PROJECT

#### Resumo

**Objetivo do estudo:** Identificar os perfis estratégicos quanto às mudanças climáticas das empresas de gestão de recursos hídricos integrantes da base de dados Carbon Disclosure Project (CDP), do ano de 2019.

**Metodologia / abordagem:** Foi realizada uma pesquisa exploratória com o uso de pesquisa bibliográfica, documental e estudo de casos múltiplos. Os dados utilizados são oriundos da base de dados CDP de 2019, analisados conforme a estrutura metodológica de Kolk e Pinkse (2005). Os dados foram analisados por meio de análise de conteúdo.

**Originalidade / relevância:** Os resultados da presente pesquisa servem como indicativo da vulnerabilidade e contribuição do segmento na manutenção e segurança da oferta de água de qualidade em médio e longo prazos.

**Principais resultados:** A maioria das organizações gestoras de recursos hídricos, ainda em 2019, enquadram-se nos perfis de Planejadores Cautelosos e Planejadores Emergentes e têm como principais direcionadores estratégicos a percepção de oportunidades, riscos e responsabilidade corporativa, nesta ordem.

#### Cite as / Como citar

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**Contribuições teóricas / metodológicas:** Como contribuições teóricas, o trabalho traz a análise de estratégias organizacionais, especificamente de empresas da área de recursos hídricos, voltadas à mitigação das mudanças climáticas. O método de análise de dados aqui adotado pode ser usado em outros segmentos de negócios que têm relação direta com recursos naturais.

**Contribuições sociais / gerenciais:** Os resultados da pesquisa podem embasar decisões e mudanças nas estratégias corporativas de mitigação de emissões de gases de efeito estufa no segmento de recursos hídricos, bem como políticas públicas para planejamento e enfrentamento das mudanças climáticas.

**Palavras-chave:** Perfil estratégico. Mudanças climáticas. Gestão de recursos hídricos. Mitigação. Carbon Disclosure Project.

### ESTRATEGIAS DE NEGOCIO PARA EL CAMBIO CLIMÁTICO DE LAS EMPRESAS GESTORAS DE RECURSOS HÍDRICOS INTEGRADAS AL CARBON DISCLOSURE PROJECT

#### Resumen

**Objetivo del estudio:** Identificar los perfiles estratégicos en materia de cambio climático de las empresas gestoras de recursos hídricos que forman parte de la base de datos del Carbon Disclosure Project (CDP), para el año 2019.

**Metodología / enfoque:** Se realizó una investigación exploratoria utilizando investigación bibliográfica, documental y estudios de casos múltiples. Los datos utilizados provienen de la base de datos CDP de 2019, analizados según la estructura metodológica de Kolk y Pinkse (2005). Los datos se analizaron mediante análisis de contenido.

**Originalidad / relevancia:** Los resultados de esta investigación sirven como indicador de la vulnerabilidad y contribución del segmento en el mantenimiento y seguridad del suministro de agua de calidad en el mediano y largo plazo.

**Principales resultados:** La mayoría de las organizaciones de gestión de recursos hídricos, aún en 2019, se ajustan a los perfiles de Planificadores Cautelosos y Planificadores emergentes y tienen como principales impulsores estratégicos la percepción de oportunidades, riesgos y responsabilidad corporativa, en ese orden.

**Aportes teóricos / metodológicos:** Como aportes teóricos, el trabajo trae el análisis de las estrategias organizacionales, específicamente de las empresas del área de recursos hídricos, orientadas a la mitigación del cambio climático. El método de análisis de datos adoptado aquí se puede utilizar en otros segmentos de negocios que están directamente relacionados con los recursos naturales.

**Contribuciones sociales / gerenciales:** Los resultados del estudio pueden respaldar decisiones y cambios en las estrategias corporativas para mitigar las emisiones de gases de efecto invernadero en el segmento de recursos hídricos, así como políticas públicas para planificar y enfrentar el cambio climático.

**Palabras clave:** Perfil estratégico. Cambios climáticos. Gestión de los recursos hídricos. Mitigación. Carbon Disclosure Project.

## Introduction

Several business initiatives and strategies have been adopted to reduce greenhouse gas emissions and adapt to climate change. This involves strategies to adapt to environmental laws through improvements in products and processes, in addition to emissions trading, especially after the ratification of the Kyoto Protocol in 1997 (Kolk & Pinkse, 2004, 2005). As these issues related to climate change gain prominence in business, corporate greenhouse gas (GHG) emission strategies are expected to change faster (Lee, 2012). These changes are due to the perception of direct or indirect transition risks such as increasing pressure from governments, activists, shareholders, consumers, and other stakeholders to reduce emissions (Eleftheriadis & Anagnostopoulou, 2017; Weinhofer & Hoffmann, 2010) and physical risks such as floods, extreme events, droughts, etc. (Eleftheriadis & Anagnostopoulou, 2017; Pörtner et al., 2022).

When analyzing the climate-related business strategies adopted by 136 companies from various business branches which are part of the Global 500, Kolk & Pinkse (2005) identified two main sets of strategies adopted by these companies. The first refers to the improvement in business activities and the company's assets and competencies through the development of new technologies or services that reduce emissions. The second set, with a compensatory approach, involves the transfer of emissions through the purchase of carbon credits. Both paths can be adopted on their own or by interacting with actors outside organizations, such as other supply chain companies, Non-Governmental Organizations (NGOs) or the government.

The same authors still consider that climate change strategies can be characterized into six strategic profiles and that most companies fit the top two, Cautious Planners and Emergent Planners, who group businesses at a preliminary stage in relation to the implementation of market strategies for climate change.

Based on the strategic profiles for climate change of Kolk & Pinkse (2005), which indicate the strategic business decision-making in the face of climate change and the singularities of specific business branches (Lee, 2012), this study aims to identify the strategic profiles of climate change of all water resource management companies that responded to the 2019 CDP questionnaire.

Being a sector that is directly related to the consumption of natural resources and is vulnerable to climate change, whose activities generate impact on the climate, it is important to study the role of water resources companies. Nevertheless, few studies analyze the relationship between climate change and the water resources sector, as well as identifying the strategies of this sector. In addition, the results of this study serve as an indication of the vulnerability and contribution of the sector in the maintenance and security of quality water supply in the medium and long term.

Thus, this paper analyzes organizational strategies aimed at mitigating climate change of companies in the area of water resources. The data analysis method adopted herein can be used in other business sectors that are directly related to natural resources. Further, the results provide information for

decision-making and changes in corporate strategies to address climate change in the water resources sector, as well as information for use in public policies to plan and cope with climate change, contributing to sustainable development.

In the case of water resources management companies in particular, the identification and management of these strategic profiles allows to identify risks involved in their operations, which might influence the provision of potable water in the medium and long term. Moreover, because they are mainly state companies or public concessions, the identification of strategic profiles can put pressure on the government's action in the operation or concession contracts of water resources management companies regarding the adoption of strategies aimed at reducing carbon emissions.

This study was limited to the water resources management companies that were the respondents to the CDP (2019) questionnaire, due to the ease of access to detailed data on the performance of these companies. The selection of the organizations analyzed was made through the filters of the CDP itself that contained the words “water” and “waste,” which resulted in the selection of 14 (fourteen) companies, of which 4 (four) were excluded from the selection, because their businesses did not have correlation with the research subject. The analysis technique was classical content analysis based on the questions of items C0 - *Introduction* and C3 - *Business Strategy*, from the CDP.

The research thus identifies strategic profiles regarding climate change of the water resources management companies that respond to the CDP (2019) and synthesizes the theoretical framework involving organizational strategies focused on climate, serving as a methodological basis for the replication of research in other business sectors.

### **Business strategies for climate change**

Because of climate change and its impact on business, efforts were directed to characterize corporate strategic responses (Kolk & Pinkse, 2004), when considering a strategy as the definition of a company's long-term goals and the adoption of actions and allocation of resources to achieve them (Chandler, 1962). According to Kolk (2000), strategies vary from a reactive stance, denying responsibility for climate change, to a proactive one regarding the perception of the risks involved (Rondinelli & Vastag, 1996) and market opportunities arising from environmental protection (Steger, 1993).

The mitigation of carbon emissions, in order to meet the internationally established goals, requires companies to significantly reduce their carbon footprint. Thus, more than ethical issues, vulnerability to extreme climate events places companies as beneficiaries of the outsourcing of environmental costs. Corporate goals to reduce carbon emissions can materialize, voluntarily, in symbolic attempts to manage stakeholders (greenwashing) or in the definition of goals aimed at reducing organizational environmental impacts. Long-term and more ambitious goals are associated with significant reductions in corporate carbon emissions, which does not exempt public policymakers and

environmental activists from vigilance regarding business intentions linked to their environmental management practices (Dahlmann, Branicki & Brammer, 2019).

For Kolk & Pinkse (2004), the understanding of the strategies adopted for climate change over time helps in the development of best practices and eliminates those that are not adequate, while a strategic typology helps managers to decide on the strategic option that best serves their organization. For the same authors, these strategies differ in their objective (strategic intention) as well as in the degree of cooperation between organizations (form of organization) when presenting the options to innovate and or compensate for emission credits. With regard to extension, they also differ on whether the focus will be on their own operations or whether it will extend to the supply chain, or even if it will go beyond it, as shown in Table 1. Compensation occurs through the purchase, sale or transfer of carbon credits (Weinhofer & Hoffmann, 2010).

**Table 1**

*Typology of market strategies for climate change*

| SCOPE                                | AIM                             |   |
|--------------------------------------|---------------------------------|---|
|                                      | <i>Innovation</i>               | <i>Compensation</i>                       |
| Internal (Company)                   | Process improvement             | Internal targets, control and trading     |
| Vertical (Supply Chain)              | Product development             | Supply chain targets, control and trading |
| Horizontal (Beyond the supply chain) | New product/market combinations | External market mechanisms                |

**Source:** Adapted from (Kolk & Pinkse, 2004, p. 6).

Climate strategies have considerable flexibility, but they depend on the business sector, activities and geographical location of companies (Grubb, Vrolijk, Brack, Forsyth, Lanchbery & Missfeldt, 1999), since they can, for example, voluntarily participate in emission reduction agreements (Kolk & Pinkse, 2005).

Regarding the flexibility of environmental regulations, companies are expected to be innovative in the form of reducing GHG emissions (Thornton, Kagan & Gunningham, 2003), especially due to the opportunity to meet the goals set by the government in cooperation with partners in the supply chain, or even expected to associate with competitors for the development of low-emission technologies or environmental services to reduce emissions via innovation (Kolk & Pinkse, 2005). Technological diffusion processes are essential in the economic impact of climate change mitigation (Aldieri & Vinci, 2020).

Emissions trading, in turn, allows companies to buy or sell certified emission reductions, which may be simpler than changing production processes or developing new products (Margolis & Walsh, 2003). Of course, a company that adopts the strategy of buying emissions depends on the supply of

credits earned by reducing emissions through innovation from other companies, which means that there is a transfer of internal emissions from one company to another (Kolk & Pinkse, 2005).

The main differences between compensation strategies and innovation are, in the latter case, the development of skills, the adequacy of the organizational resource base and the development of an organizational learning process (Kolk & Pinkse, 2004). Essential competencies (Prahalad & Hamel, 1990) or strategic capabilities as resource integration routines (Grant, 1991) refer to the organization's collective learning in coordinating production skills and integrating technologies (Grant, 1991; Prahalad & Hamel, 1990) to develop competitive advantages (Kor & Mahoney, 2004).

Organizational resources can be physical, such as technology, equipment, industry plant, access to raw materials and geographical location, and resources involving humans, which includes training, professional experience, knowledge, individual skills and interpersonal relationships, and organizational capital resources, such as structure, formal and informal planning, coordination control systems and the relationship between organizations and the environment (Barney, 1991; Wernerfelt, 1984). The diversification of productive activities through the reconfiguration of resources and capabilities initiates the development of new products (Penrose, 2006), considering that dynamic and competitive markets drive companies to seek means to adapt and explore changes in their business environment (Teece, 2007; Teece, Pisano & Shuen, 1997).

Kolk & Pinkse (2004) considered that most companies at the time focused on internal guidance measures aimed at improving the energy efficiency of their businesses, while exploring possibilities to integrate the supply chain into their climate strategy and the development of new energy-efficient products, the latter with the possibility of cooperation between companies and countries.

Regarding the measures adopted in relation to climate change, Kolk & Pinkse (2005) point out that, in the face of climate change, companies can adopt all the measures pointed out by them, but they can also adopt a combination of such measures. The authors also emphasize that the strategies will depend on the managerial perception of risks and opportunities of climate change.

Compensatory actions are usually adopted when there is higher perception of risks, given that compensation does not require organizational change processes proportional to the adoption of innovations in production processes and products. Otherwise, innovation is characteristic of organizations that envision opportunities related to climate change and that are willing to take the risk of large-scale investments to develop environmentally friendly technologies, maximized by the perception that the longevity of the company depends on it (Kolk & Pinkse, 2005).

Just measuring GHG emissions does not fully comprise the company's practices regarding climate change, because they also involve: a) improving processes (technology); b) developing new products (in terms of energy efficiency or adopting measures to reduce other GHGs); c) measuring GHG emissions from the supply chain and adopting emission mitigation or compensation measures (product development and compensatory actions); d) developing partnerships (strategic alliances for the development of new products and or entering new markets and or entering into voluntary agreements

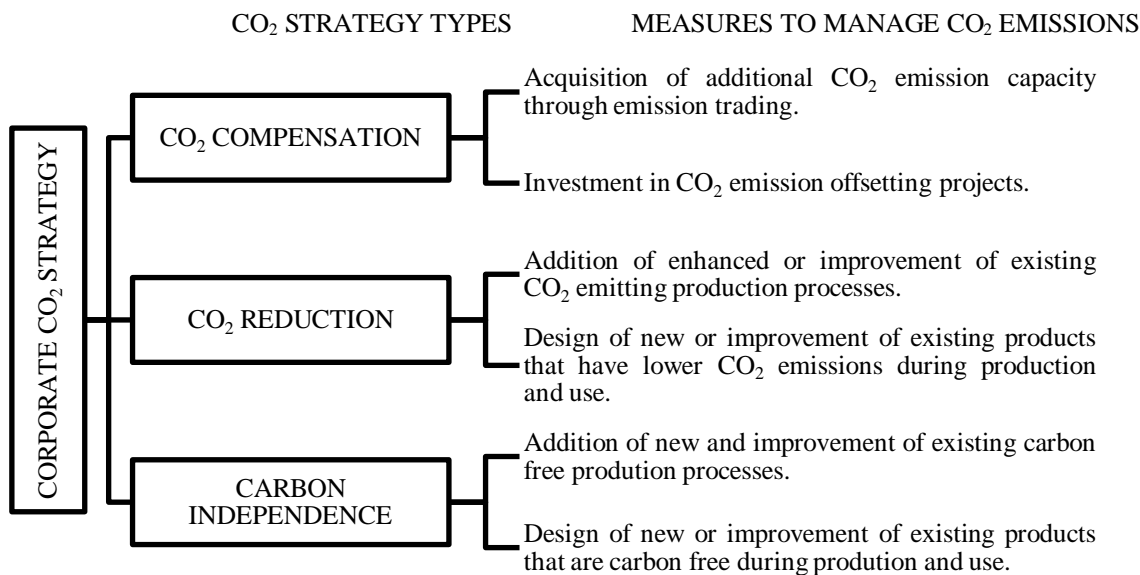
with governments and NGOs); e) adopting market mechanisms aimed at climate change (emissions trading or participation in compensation projects), in addition to changing organizational culture (employee awareness of climate change) (Kolk & Pinkse, 2004, 2005).

Specifically regarding CO<sub>2</sub> emission, Weinhofer & Hoffmann (2010) considered that a generic corporate strategy for the emission of carbon dioxide (CO<sub>2</sub>) can be guided by the compensation or reduction of CO<sub>2</sub>, or even by its independence, as shown in Figure 1. Compensation refers to the organization's actions to balance or offset its CO<sub>2</sub> emissions, such as the purchase of carbon credits or the improvement of carbon sinks, in order to reduce the pressures relevant to emissions, however, in this case, the cause of such pressures is not resolved, which makes them short-term solutions.

The CO<sub>2</sub> reduction reflects the need to reduce emissions in the long term. In this scenario, companies change production processes and products to optimize their reduction. Carbon independence refers to a more distant timeframe, in which organizations transform business operations to achieve independence from fossil resources by replacing carbon resources with renewable resources (Weinhofer & Hoffmann, 2010).

**Figure 1**

*Generic corporate CO<sub>2</sub> strategy framework*



**Source:** Adapted from (Weinhofer & Hoffmann, 2010, p. 80).

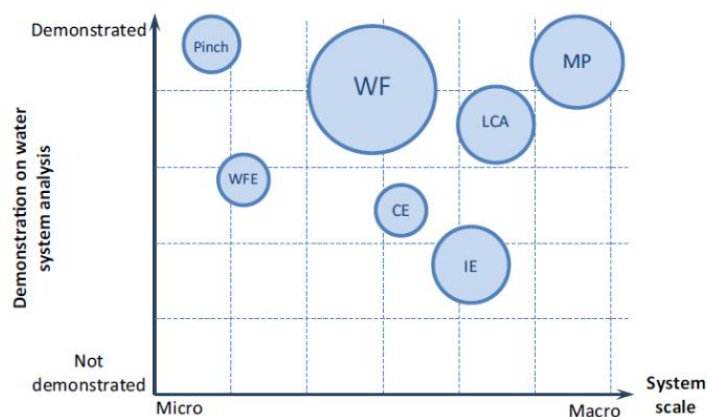
The company's carbon strategy can, as in Kolk & Pinkse (2005), focus on one of the aspects highlighted in Figure 1, or a combination of them (Weinhofer & Hoffmann, 2010). In the cases studied by Weinhofer & Hoffmann (2010), it could be observed that most organizations adopt long-term emission management measures despite the existence of companies whose focus is either the short term or the adoption of no measures regarding climate change.

Cadez & Czerny (2016) studied 158 carbon-intensive companies and distinctly realized that these companies focus on a single climate change mitigation strategy, rather than implementing multiple strategies simultaneously. This consideration takes into account the strategy literature that companies should allocate their resources to environmental investments in which the expected return is higher (Petkova, Wadhwa, Yao & Jain, 2013). Carbon-intensive companies mainly engage in marginal efficiency improvements that do not require significant investments, with the purpose of reducing economic risks, rather than contributing to the transition to a less carbon-intensive society, so the rigor of policies has a positive effect on corporate efforts to reduce emissions (Cadez & Czerny, 2016).

When considering a rational strategy for adapting to climate change, water resource management is a complex problem that requires innovation to generate scalable solutions, as shown in Figure 2. The bubble size corresponds to the volume of the scientific literature in the Scopus database, that is, it scales the studies of the tools used for water resource management in the face of climate change, such as Pinch (Process Integration on Programming Analysis), WFE (Water, Food, Energy Nexus), WF (Water Footprint), CE (Circular Economy), IE (Industrial Ecology), LCA (Life Cycle Analysis), MP (Mathematical Programming) (Tan & Foo, 2018).

**Figure 2**

*Roadmap for an integrated, multi-scale water management framework*



**Source:** Adapted from Tan & Foo (2018, p. 1125).

### *Strategic drivers for climate change*

Kolk & Pinkse (2004) considered that government regulation on climate change, arising from the ratification of the Kyoto Protocol or the possibility of its ratification by the local government, acts as a driver for companies to reduce GHG emissions, in a strategy to reduce operational risks, or even as a business opportunity for some sectors, such as financial companies, since they can facilitate emissions trading. Regulatory uncertainty was also considered as a strategic driver for the mitigation of GHG emissions by Cadez, Czerny & Letmathe (2019), as well as stakeholder pressures.

Other opportunities were perceived in the possibility of reducing operating costs, especially due to energy savings and increased competitiveness, through innovation in processes and development of new products, which lead to a competitive advantage and improves the organization's reputation in the perception of its stakeholders. The risk of climate-related catastrophes was also perceived as a strategic driver for climate change, although some companies disregard this effect, as they expect catastrophes to occur outside the operational horizon of the business (Kolk & Pinkse, 2004).

Eleftheriadis & Anagnostopoulou (2017) considered that companies need to go beyond the commitment of top management to climate change in order to succeed in implementing climate-focused strategies, namely, the incorporation of climate change risk management procedures in the main business activities and the establishment of precise carbon reduction goals, as a means of implementing successful strategies that can be measured through indexes.

Hoffman (2005) and Kouloukoui, Marinho, Gomes, Kiperstok & Torres (2019) addressed that many organizations are agnostic about climate change and that the reasons why they adopt policies to reduce greenhouse gas emissions are remarkably strategic. The drivers of voluntary emission reduction are based on opportunities for operational improvement, especially regarding energy efficiency, anticipation of climate regulations and influence on their direction, access to financial incentives for the reduction of GHG, improvement of risk management (natural and economic), human resources and corporate reputation (Hoffman, 2005).

Directing the company to be “green” in relation to competitors represents an opportunity for differentiation in the market through innovation and reduction of operational risks, since the mechanisms for controlling GHG emissions represent a transition to the new social, economic, environmental and regulatory demands. This consideration ratifies the importance of managers reevaluating their operations, policies, sources of capital, risk management and organizational culture and adapting them to climate change through GHG mitigation and negotiation instruments (Hoffman, 2005).

Less optimistically, Kouloukoui et al. (2019) consider that regulation is the best driver for engaging companies in actions to address climate change. The regulation addressed by the authors does not simply concern the enactment of laws that oblige companies to disclose information on climate risks in order to only comply with the rules and/or obtain ranking scores, but rather, laws that serve to monitor, audit and control actions regarding climate change, which associates the results of corporate strategies to the actions of the governments of each country.



**Table 2**

*Synthesis of strategic drivers for climate change*

|                          |  |
|--------------------------|--|
| RISKS                    | <ul style="list-style-type: none"> <li>● Changes in environmental laws and regulations.</li> <li>● Environmental catastrophes (physical hazards).</li> </ul>   |
| OPPORTUNITIES            | <ul style="list-style-type: none"> <li>● Improvement of production processes and products, via innovation.</li> <li>● Reduction of operating costs, especially due to energy efficiency.</li> <li>● Access to funding sources aimed at sustainable development.</li> <li>● Engagement of the company's human resources.</li> <li>● New business development (via innovation and formation of strategic alliances).</li> <li>● Development of competitive advantage.</li> </ul> |
| CORPORATE RESPONSIBILITY | <ul style="list-style-type: none"> <li>● Improvement of the company's reputation vis-à-vis its interest groups, in particular investors, customers, employees, and governments (national and international).</li> </ul>  |

**Source:** Authors' own elaboration from Dahl & Fløttum (2019); Eleftheriadis & Anagnostopoulou (2017); Hoffman (2005); Kolk & Pinkse (2004, 2005); Kouloukoui et al. (2019).

The economic analysis of climate change confirms that organizational operations are linked to the global climate, so sustainable strategies can be demanded by public policymakers (Aldieri & Vinci, 2020).

Organizational direction towards climate change varies from organization to organization and can be summarized in three main approaches (or a combination of them): a) climate change as corporate responsibility; b) climate change as risk management; and c) climate change as business opportunities (Dahl & Fløttum, 2019).

*Business strategy profiles on climate change*

Based on the typology developed by Kolk & Pinkse (2004), Kolk & Pinkse (2005) identified six strategic profiles for climate change that can be adopted by companies, based on the combinations of types of strategies for climate change presented in Table 1, which were summarized in Table 3. These profiles represent groups of strategies adopted.

Table 3

Strategic profiles on climate change

|                             |   |
|-----------------------------|---|
| <b>CAUTIOUS PLANNERS</b>    | <p>Companies that adopt few or almost none of the strategies addressed in the typology of Kolk &amp; Pinkse (2004). Its posture is characterized as preparation for action, with few activities aimed at climate change in the different areas of the organization. They usually mention measures to reduce GHG emissions as a possibility to be adopted in the future, without providing specific details of the <i>modus operandi</i>.</p> <p><b>Example:</b> the company reports its efforts to reduce emissions in the CDP, however, its current position regarding effective GHG emission reductions is not clear, reduction targets are not mentioned and limited possibilities for process improvements are envisaged.</p>   |
| <b>EMERGENT PLANNERS</b>    | <p>They characterize organizations that have started a process of developing a more comprehensive climate strategy in the coming years, by establishing a goal to reduce energy consumption and/or GHG emissions, at an early stage regarding the implementation of changes in organizational routines to achieve the objective of reduction of GHG emissions. Measures beyond the processes of setting reduction targets, with the aim of effectively reducing emissions, are not mentioned.</p> <p><b>Example:</b> CDP reports the establishment of GHG emission reduction targets, but there is no indication of sufficient business improvements to achieve the targets. The market opportunities arising from climate change do not reside in the redesign of products or processes, but in stakeholder recognition of the company's environmental initiatives. There is the possibility of generic reporting of emission reductions in the supply chain.</p>  |
| <b>INTERNAL EXPLORERS</b>   | <p>The central characteristic of this profile are companies that have a strong internal focus, by combining targets and improvements in production processes, which result in the reduction of production costs, due to energy efficiency, whose intention is to reduce CO<sub>2</sub> emissions.</p> <p><b>Example:</b> the company provides information in the CDP that it has established a specific energy savings target in a period and or scales the savings in different periods and, for this, cites the adoption or development of energy efficient production technologies.</p>  |
| <b>VERTICAL EXPLORERS</b>   | <p>Vertical explorers focus on measures within the supply chain. Although these companies are in the process of obtaining information on GHG emissions resulting from their own activities, they see opportunities to develop more energy-efficient products and to engage with their suppliers to reduce GHG emissions. There are two reasons for companies to focus on upstream and downstream activities. The first is the dependence on natural resources vulnerable to extreme weather conditions, the second refers to its manufacturing process having a relatively low climate impact compared to the consumption of resources from the supply chain.</p> <p><b>Example:</b> the company is susceptible to natural disasters such as floods and droughts. In addition, the impact of your products may depend on consumer behavior at the time of use. Measures related to downstream activities consist of product design based on its life cycle and programs to increase consumer awareness.</p> |
| <b>HORIZONTAL EXPLORERS</b> | <p>Companies in this profile adopt business strategies for climate change in most dimensions addressed in the typology of Kolk &amp; Pinkse (2004) but are dedicated to a specific activity. In this case, exploring opportunities in markets outside the company's ordinary business scope, with the possibility of cooperation with partners.</p> <p><b>Example:</b> The company uses the by-products of its core business to enter a new market.</p>   |
| <b>EMISSIONS TRADERS</b>    | <p>Organizations with this profile adopt business strategies for climate change in most dimensions addressed in the typology of Kolk &amp; Pinkse (2004). In this profile, companies focus on emissions trading opportunities and combine them with an internal reduction target and a favorable position towards new products and markets. Rather than offering products that facilitate emissions trading, these companies either trade certified emission reductions or act as intermediaries for other companies.</p> <p><b>Example:</b> creation and/or participation in businesses dedicated to the carbon market, in addition to the possibility of obtaining certified emission reductions through emission reduction projects or participation in them.</p>  |

Source: Authors' own elaboration from Kolk & Pinkse (2005).

The structure that reflects the definition of the corporate carbon strategy combines the scope and level of the company's carbon management activity in several areas, and the strategy adopted is influenced by the business sector and the size of the organization. Companies in more energy-intensive

sectors usually adopt carbon strategies related to reducing emissions, in contrast, the service and manufacturing sector has a predilection for developing more environmentally friendly and energy-efficient products. As for the size of the organization, larger companies are more likely to adopt energy-efficient actions than smaller ones (Lee, 2012).

### Methodological procedures

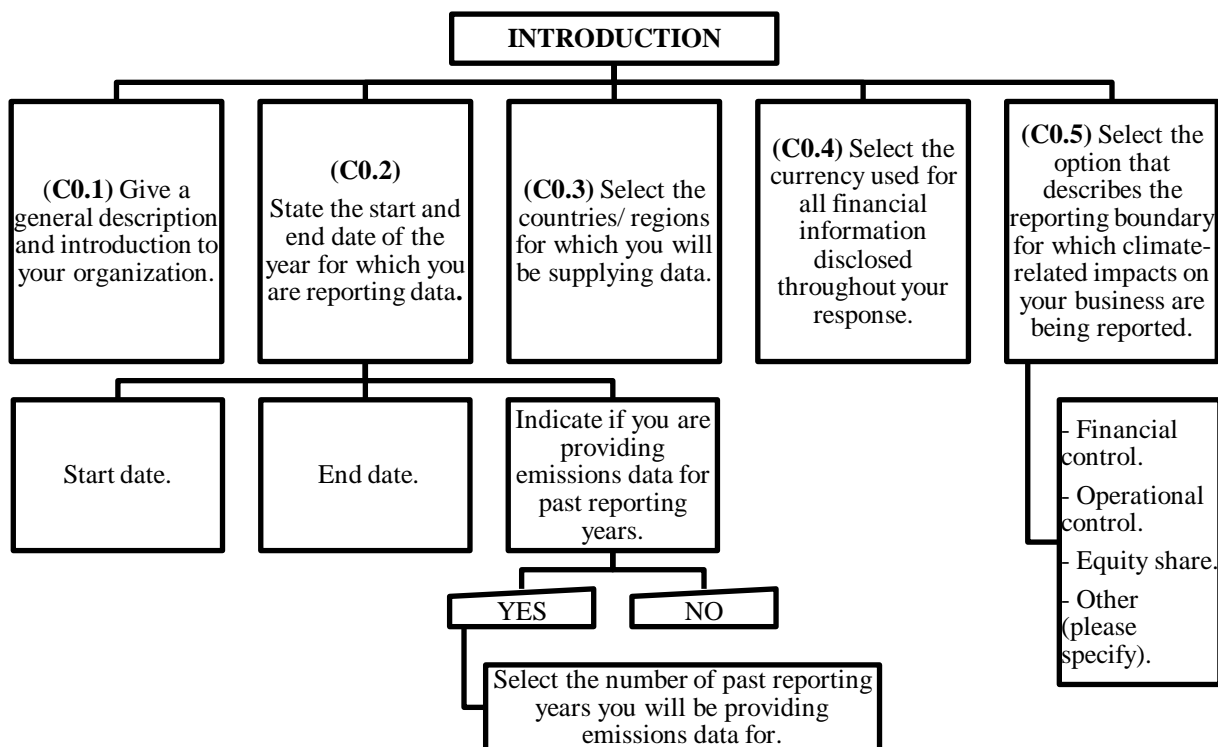
This study used a qualitative approach, bibliographic and documentary research and multiple case studies, using the classical content analysis technique to classify water resource management companies into six company profiles identified by Kolk & Pinkse (2005) regarding climate change strategies. The research has a qualitative approach, as it represents a way of understanding the nature of a social phenomenon, such as the formulation of strategies, and because it covers “the attempt to understand the relevant meanings and situational characteristics in detail” (Richardson, 1999, p. 90).

The water resources sector was chosen as part of the CDP (2019) database, whose data are from 2018, due to challenges pertaining to its sustainable management, such as climate change, drought and population growth, according to Sachidananda, Patrick Webb & Rahimifard (2016), and the costs of water services (Boyle, Giurco, Mukheibir, Liu, Moy, White & Stewart, 2013). In addition, the database was selected due to the availability, detailing and comprehensiveness of the data that the institution collects annually, as well as the reputation of such institution.

The literature research aimed to support content analysis, especially the work of Kolk & Pinkse (2005). Kolk & Pinkse (2005), in their Appendix 1, listed six areas related to climate change strategies, namely: 1) process improvement; 2) internal transfer of emission reduction; 3) product development; 4) measures regarding the supply chain; 5) new product/market combinations; and 6) acquisition of carbon credits. Each of these areas was analyzed from the perspective of five different aspects, which classify companies in one of the strategic profiles regarding climate change, which are summarized in Table 3. Similarly, this text used the classification methodology of the authors mentioned above, focusing on the answers given in the CDP to the questions specified in Figures 3 and 4.

Figure 3

General CPD Questions 2019: C0 – Introduction

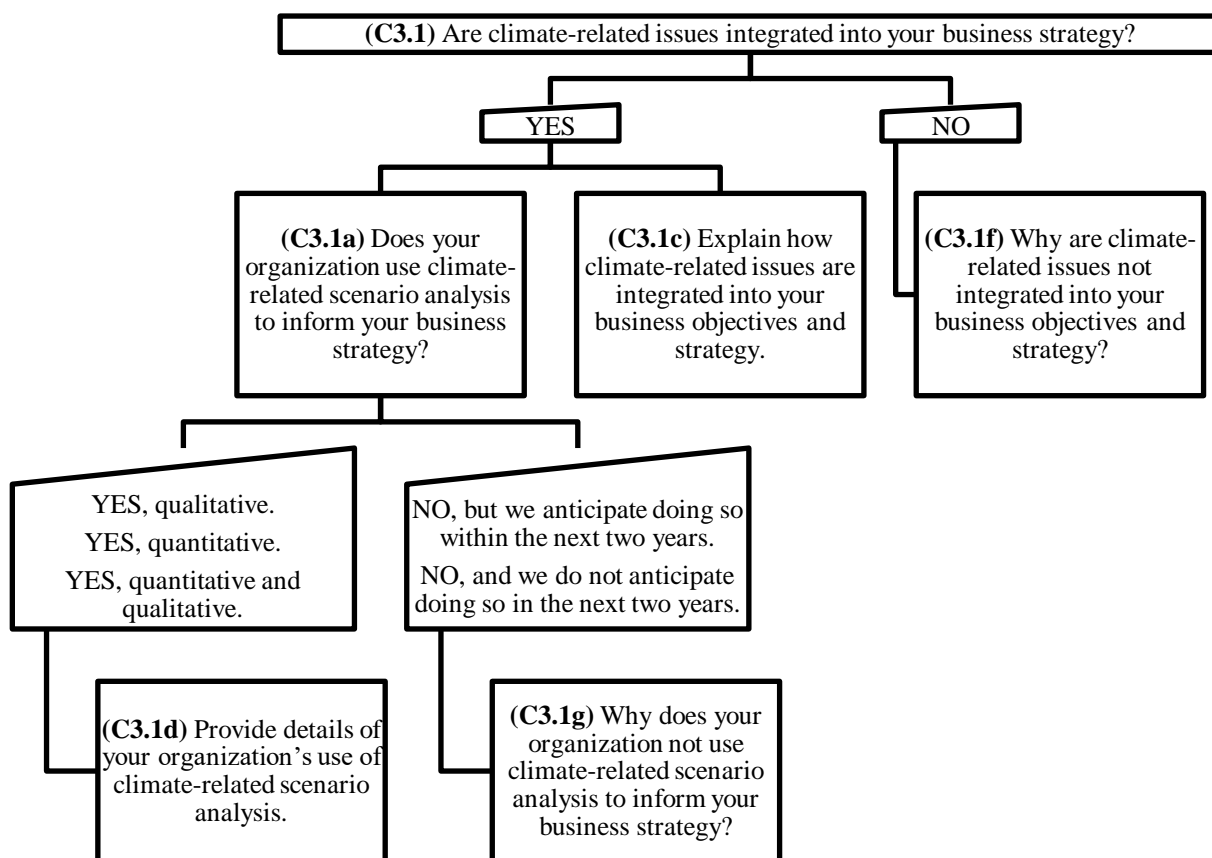


Source: Authors' own elaboration (2020), from CDP (2019).

The answers given in the CDP to the questions specified in Figures 3 and 4 are voluntary, that is, provided by organizations themselves and not verified by the organization promoting the report. Nevertheless, Dahlmann et al. (2019) identified that ambitious and long-term goals aimed at mitigating climate change are associated with significant reductions in GHG emissions, in addition to not exempting the verification of these goals by public policy makers and environmental activists. Moreover, it is important to highlight that even though the responses are voluntary and not verified by the organization that sponsors the report, organizational image problems and non-investment can lead to transparent responses by companies.

Figure 4

Specific CPD Issues 2019: C3 – Business Strategy



Source: Authors' own elaboration (2020) from CDP (2019).

The classical content analysis technique was used to focus on the numerical descriptions of the characteristics found, as well as to identify and analyze types, qualities and distinctions in the texts (Bauer, 2002; Vergara, 2005) through systematic and objective procedures to describe the content of messages and indicators (quantitative or not) that allow the inference of knowledge (Bardin, 2009).

Nine filters were used for the selection of water resources management companies to be analyzed and the selection criterion was to contain the words “water” and “waste” in the activities column of the CDP (2019), namely: I) engineering services, transportation infrastructure & other construction, waste management, water supply networks; II) industrial services, waste management, water supply networks; III) other professional services, waste management; IV) utility line construction, waste water management, water supply networks; V) utility line construction, water supply networks; VI) waste management; VII) waste management, water supply networks; VIII) waste water management; IX) water supply networks.

Out of the previously mentioned filters, 14 (fourteen) companies were selected and, when considering the analysis of the field C0.1 (Figure 3), 4 (four) organizations were excluded from the selection because they had no correlation with the research subject, leaving 10 (ten) organizations to be

analyzed (Table 4). Thus, this research constitutes of the multiple study of ten cases. The case study method was adopted because it allows to investigate a contemporary fact in depth and in its world context. The multiple case format consists of “single cases, usually separated into chapters or sections” (Yin, 2015, p. 188).

**Table 4**

*Organizations selected for analysis from the CDP (2019)*

| №  | ORGANIZATION                            | ACTIVITY FILTER   | COUNTRY        | PRIMARY ACTIVITY       | REPORTING BOUNDARY  |
|----|---|---|----------------|------------------------|---------------------|
| 1  | Anglian Water                           | Waste water management  | UK and Ireland | Waste water management | Operational control |
| 2  | Fomento de Construcciones y Contratas   | Engineering services, Transportation infrastructure & other construction, Waste management, Water supply networks | Spain          | Waste Management       | Operational control |
| 3  | Pennon Group                            | Waste management, Water supply networks   | UK and Ireland | Waste Management       | Financial control   |
| 4  | Severn Trent                            | Waste management  | UK and Ireland | Water supply networks  | Financial control   |
| 5  | Suez                                    | Utility line construction, Water supply networks  | France         | Water supply networks  | Operational control |
| 6  | United Utilities                        | Other professional services, Waste management   | UK and Ireland | Water supply networks  | Financial control   |
| 7  | Veolia Environnement SA                 | Waste management, Water supply networks   | France         | Water supply networks  | Operational control |
| 8  | Cia Saneamento de Minas Gerais – COPASA | Waste management  | Brazil         | Water supply networks  | Operational control |
| 9  | American Water Works                    | Water supply networks   | U. S           | Water supply networks  | Financial control   |
| 10 | Aqua America Inc.                       | Industrial services, Waste management, Water supply networks  | U. S           | Water supply networks  | Financial control   |

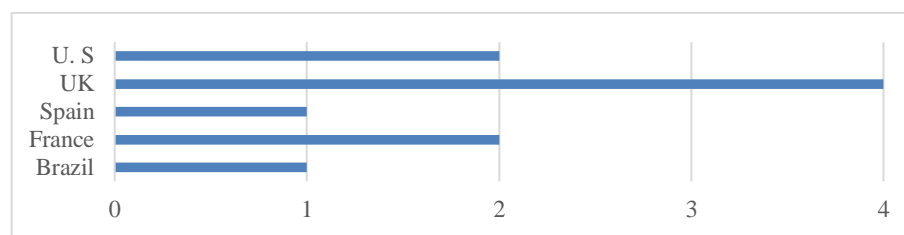
**Source:** Authors’ own elaboration (2020), from CDP (2019).

### Discussion of the results

From the analysis of Table 4, it can be seen that, of the nine filters used for the selection of companies, eight of them had correspondence with the research, with the exception of the filter “utility line construction, waste water management, water supply networks,” which did not return any results. Two remaining eight filters, two of them returned two results each (“Waste management, Water supply networks” and “Waste management”) and the remaining six only corresponded to one result each. Most of the organizations analyzed are in European countries (Figure 5) and the cases selected for analysis are companies that provide drinking water or waste water management services, or both.

**Figure 5**

*Distribution of organizations analyzed by country*



**Source:** Authors' own elaboration (2020).

In addition, all the analyzed organizations operate in the infrastructure sector and, as for the limits of the report, 50% of them use it for “financial control” and 50% for “operational control,” thus, there is no company whose limit is “equity interest,” an option addressed in Question C0.5 (Figure 3). All responses considered in the data analysis were made available by the managers of the organizations studied between July and September 2019 and refer to data between January and December 2018 (6 companies) or between April 2018 and March 2019 (4 companies).

Regarding climate strategies, all companies analyzed answered that climate-related problems are integrated into their business strategies and, with the exception of CIA Saneamento de Minas Gerais (COPASA), all use climate-related scenario analysis to inform their business strategies. Although COPASA does not use scenario analysis, it plans to use it in the next two years.

#### *Anglian water*

The company Anglian Water provides drinking water and waste water management services and presented CDP (2019) data for England and Wales. Due to the location of its pipes in flat and low regions, there is a need to use energy to pump the water, and much of the region served is below sea level, which presents the risk of flooding. Despite the acknowledgment of energy expenditure, no innovation was presented in the report as a means or intent to mitigate it, according to the climate change strategies addressed by Kolk & Pinkse (2004).

Anglian Water aims to make eastern England resilient to the impacts of drought and floods and become a carbon neutral business by the year 2050, through annual carbon reduction targets. As positive factors, there was the acknowledgment of floods (natural catastrophe) as an operational risk factor and the intention to develop actions to curb it, as addressed by Kolk & Pinkse (2004) and Hoffman (2005), when dealing with the reduction of natural risks, in addition to the objective of becoming, in a limited time frame, a carbon-neutral business, as addressed by Weinhofer & Hoffmann (2010) in Figure 1.

The company has committed to the local government to submit adaptation reports on climate change and issue Green Bonds to mitigate risks and enhance transition opportunities related to climate change. Green Bonds are bonds issued to raise funds for investments in projects aimed at sustainable development (Zerbib, 2019). Thus, the company's proactivity regarding the risks and opportunities

arising from climate change is noticeable, as in Rondinelli & Vastag (1996) and Steger (1993) respectively.

In the short term, the company highlighted that it will continue to issue Green Finance bonds and that it will operate together with competitors to agree on a net zero carbon target for the sector. Green Finance is aimed at financing green, public and private investments (European Union, 2017). Hoffman (2005) had already addressed access to funding sources from the adoption of an environmentally friendly strategy, as well as Kolk & Pinkse (2005) highlighted the importance of association with other organizations, even competitors, in order to achieve the net zero carbon goal in the sector.

The justification for actions in response to climate change is that the carbon reduction of operations is already contributing to the reduction of the company's operating costs, which results in greater efficiency in relation to competitors, a competitive advantage via differentiation noted by Hoffman (2005). Despite this, it was not clear what are the short-term actions that contribute to carbon reduction, as well as what are the ways of measuring both carbon reduction and operating costs and their effects on business. This business gap in the establishment of precise carbon reduction goals as a means of implementing successful strategies, which can be measured through indexes, was addressed by Eleftheriadis & Anagnostopoulou (2017).

As for the climate-related scenario analysis, Anglian Water uses the UKCP09 tool for climate projections, with quantitative forecasts for the years 2025, 2045 and 2065, with the purpose of evaluating climate risk in the investment program and SRES A1B, A1FI and B1 in the evaluation of GHG emissions from water resources, qualitatively. The SRES A1B and A1FI address the use of more efficient technology to reduce GHG emissions, while the SRES B1, in addition to the introduction of clean and resource-efficient technologies, addresses reductions in the use of materials (Intergovernmental Panel on Climate Change, 2020).

The strategic drivers for climate change perceived by Anglian Water are the risks of changes in laws and regulations, opportunities to reduce operating costs and access to sources of funding aimed at sustainable development and concern for the company's reputation among its stakeholders, as shown in Table 2. The strategic profile (Table 3) identified was that of "Cautious Planners," due to the company's actions being characterized as preparation for action, with few activities directed to climate change.

#### *Fomento de construcciones y contratatas*

Fomento de Construcciones y Contratatas (FCC) has a varied business portfolio, however, this research is analyzing only Aqualia, which focuses on water management, corresponding to 6.2% of the organization's revenues and being present in 22 countries. As for your climate change strategy:



The company has a corporate climate change strategy, approved in 2012 and currently under review in the new CSR 2020 Master Plan, to adapt it to the new legislation and the most recent agreements. The objective of this strategy is to mitigate the risks associated with climate change by also taking advantage of the business opportunities (Question C3.1c – Figure 4).

In order to achieve the above objectives, Aqualia undertook sharing its climate change strategy with its stakeholders, improving the efficiency of the processes involved in water management, as well as reduce the use of resources spent for this purpose, adapt to new standards and regulations and, regarding carbon footprint, calculate the group's GHG emissions. Energy consumption, since 2010, is in compliance with the UNE ISO 5000 and, since 2017, certifies energy efficiency in accordance with Royal Decree 56/2016 of the European Parliament. Considering the ISO and the mentioned certification, a significant reduction in the carbon footprint of the business could be observed.

The risks and opportunities arising from climate change, as well as in Anglian Water, were perceived as the reasons for the adoption of climate strategies, focusing on the adaptations demanded by the legislation, which reinforces the dependence on regulations perceived by Kolk & Pinkse (2005) and Kouloukoui et al. (2019). As for the typology of strategies of Kolk & Pinkse (2004), Aqualia cites internal measures of both innovation and compensation (Table 1), the latter only regarding the control of emissions and not their commercialization, without going into detail.

The analysis of the company's scenarios is carried out using its own methodology when calculating the carbon footprint of each of its activities and it serves as the basis to define objectives and reduction measures, which were not addressed. It was otherwise acknowledged that “the FCC Group already has a long way to go in terms of measuring the carbon footprint” (Question C3.1d – Figure 4).

Aqualia's strategic drivers for perceived climate change are the risks of changes in laws and regulations as well as physical risks, opportunities for process improvement and corporate responsibility for its interest groups, as shown in Table 2. The strategic profile (Table 3) identified was that of “Cautious Planners,” as the company reported its efforts to reduce GHG emissions, however, its current position regarding the effective reductions of GHG emissions is unclear, due to the lack of measurement of reduction goals, in addition to not mentioning what were the improvements in their processes.

### *Pennon group*

South West Water (SWW) and Bournemouth Water (BW), located in the UK, are part of the Pennon Group and provide drinking water and waste water management services. The group's strategy for climate change balances opportunities to reduce operational costs and minimize physical risks, especially water scarcity, and regulatory risks, focusing on partnering to achieve its strategic objectives, namely with the UK Environment Agency. The company offers carbon management services to its customers, focusing on possible changes in legislation, as addressed by Kolk & Pinkse (2004, 2005).

The organization has set a goal of carbon independence by 2030, by the measures highlighted by Weinhofer & Hoffmann (2010) in Figure 1 and in the short term (1 to 5 years), considering that its strategic actions regarding climate change are:

[...] the early actions we are taking to make our infrastructure more resilient to climatic changes and in the carbon reduction targets established by our subsidiary companies, all of which invest significantly in energy efficiency and renewable energy to reduce both operational costs and GHG emissions (Question C3.1c – Figure 4).

The *Upstream Thinking* project in this respect is noteworthy because, through the restoration of swamps, sequestration and storage of carbon is performed, in addition to contributing to the reduction of the use of energy and chemicals in the downstream treatment of water. The scenario analysis tool used is UKCP09, focusing on supply and demand forecasts, treated in a staggered and detailed manner in the CDP (2019), when outlining 11 (eleven) climate change scenarios, inserted and considered in the Water Resources Management Plans and in the organization's 2020-2025 Business Plan.

Once again, risks of changes in laws, regulations and environmental disasters, opportunities to reduce operational costs, and concern for the company's reputation among its interest groups (Table 2) were cited as strategic drivers in relation to the climate, but in this case, when presenting details about them, instead of just mentioning them, they mention the establishment of partnerships to address the problem. In addition, the Pennon Group addresses the concern involving GHG emissions from its supply chain in its report, without quantifying it, and addresses measures already underway aimed at reducing the internal carbon of its operations, but which are insufficient to achieve the established goals, characteristics of the “Emergent Planners” profile (Table 3).

### *Severn trent*

Severn Trent is comprised of three companies, Severn Trent PLC, Severn Trent Water and Severn Trent Services, and provides potable and waste water management services. The strategic orientation of companies is focused on risk management of their businesses, from an internal perspective, with the purpose of serving their interest groups, especially environmental and economic regulators, customers, government, and investors. The companies' climate mitigation plan has as objectives for 2030 the neutrality of carbon emissions, as shown in Figure 1, and the use of energy from renewable sources only, supported by the short-term carbon reductions already achieved and investments in renewable energy generation, through business diversification.

The Carbon Trust Standard recognizes our consistent emissions reductions and effective carbon management processes. [...] We again increased renewable energy generation across Severn Trent (including the total generation of energy from Agrivert food waste business, which we purchased in December 2018) (Question C3.1c – Figure 4).

It is estimated that 50% of Severn Trent's electricity needs are met by renewable energy sources, with benefits in reducing the risk of blackout and costs of its operations, and positive financial consequences for customers and investors. The opportunity to reduce costs was highlighted by Kolk & Pinkse (2004).

As for the management of water resources, its main business, the company promotes actions to increase the resilience of its systems, when considering the risks of flooding, population growth, drought and environmental obligations, through innovations in water and sewage treatment systems, water meters and pipe leakage reduction, in order to obtain an operational competitive advantage. In addition, the group of companies has a pro-environment internal code of conduct.

Severn Trent's strategic drivers are in line with the approaches of Kolk & Pinkse (2004) and Eleftheriadis & Anagnostopoulou (2017) regarding physical and regulatory risks, Kolk & Pinkse (2004) regarding innovations in processes and products as well as the reduction of operating costs due to energy efficiency, Kor & Mahoney (2004) and Kolk & Pinkse (2005) regarding obtaining a competitive advantage, and Kolk & Pinkse (2004) and Hoffman (2005) in improving the organization's reputation in the perception of its stakeholders. Because the company adopts climate-oriented business strategies in various dimensions of Kolk & Pinkse (2004) and has entered a new market outside its business scope (renewable energy), it is characterized as having the profile of “Horizontal Explorers.”

The scenario analysis tool used is the UKCP09, strengthened by a water resources modeling system in the projection of the balance of water supply and demand in 25 years, by using as variables the population forecast, environmental impacts of water abstraction, and deterioration of raw water quality.

### *Suez*

Suez is a company dedicated to the provision of environmental services (waste and water management), present in more than 40 countries, including Brazil, and, due to the nature of its business, in particular, intelligent circular economy solutions in waste management, it manages to reduce the global carbon footprint of its business.

While the absolute rise in the Group's greenhouse gas emissions in 2018 is due to the change in the scope of consolidation following the acquisition of the former GE Water, the average carbon intensity of the Group's activities continued to fall, illustrating the resolute low-carbon focus of the projects backed by the Group (Question C0. 1 - Figure 3).

There are several strategies aimed at climate change in the organization, some in progress and others planned. The first strategy in progress is the recovery of waste and production of secondary raw materials, with the aim of reducing GHG emissions, and the adoption of contractual clauses to reduce the carbon footprint of its suppliers, perceived in:

Circular economy solutions, for example, have avoided emissions of over 10 million tons of CO<sub>2</sub>, while 55% of contract with supplier include CSR clauses. [...] a key component of its business development strategy in water management (Question C0.1 – Figure 3).

Also with regard to the stock portfolio, Suez's subsidiaries in Australia, Chile and France implemented the biofactory project, which has the function “to convert the city's wastewater treatment plants into carbon-neutral, zero-waste biofactories by 2022” and which are “able to become renewable resource production centers (water and energy)” (Question C0.1 – Figure 3). In order to optimize the efficiency of water and effluent treatment with a reduced water and carbon footprint, Suez diversified its business by acquiring GE Water, dedicated to industrial water treatment solutions with the purpose of promoting:

Continued efforts to make wastewater treatment plants able to transform all the effluents in resources, such as recycled water, fertilizer, biogas, electricity, and heat. [...] A strategy of alliances with companies and regional ecosystem players throughout the entire circular economy value chain (Question C3.1c – Figure 4).

Suez also develops projects in partnership with other organizations in various sectors to reduce GHG, such as the partnership with Australian Paper mentioned in the CDP (2019). For the reference year of the report, the carbon emission reduction of the water and effluent businesses was “2,463,201 tCO<sub>2</sub>e, i.e., 27% of total Group emissions” (Question C0.1 – Figure 3). In addition, in partnership with Crédit Agricole Corporate and Investment Bank, in 2019, a credit line linked to sustainable development was launched. Also noteworthy is the provision of internal training on sustainable development strategies.

Long-term strategies include the insertion in new markets around the world and in new customer sectors, with the innovation in products and production processes aimed at reducing the carbon footprint of the organization and its customers as an accelerator of the market expansion strategy. “Suez committed to reduce its own carbon footprint by 30% in 2030 and to offer mitigation solutions to its customers in order to avoid them 60 million tons of CO<sub>2</sub> by 2021” (Question C0.1c - Figure 3). In addition to the strategy mentioned above, the renewable energy development plan supports the organization's operations and aims to reduce the carbon footprint resulting from the purchase of GE Water.

In the short term, Suez plans to invest in physical infrastructure and Research & Development (R&D) dedicated to low-carbon technologies and projects targeting climate change, namely, desalination, solar energy, biogas, biofuels, optimized recycling systems, and B2B digital trading platforms, and as can be seen, there is business that goes beyond those focuses of the organization. Lastly, we highlight the development of carbon price schemes internally, which serve to obtain a competitive advantage, and the company's intention to anticipate measures directed to climate change in order to have access to the World Bank's climate-related investment lines.

The scenario analysis tool used is the 2DS, which addresses scenarios in which it is possible to limit the global temperature increase to 2°C (Gota, Huizenga & Peet, 2016). In addition, the Aqueduct tool was used to assess water-related risks, which indicated that 9% of Suez's water abstraction and waste water treatment sites are located in water-risk areas. As a result of the scenario analyses, the need for continuous GHG reduction was noted, particularly via energy efficiency measures and energy use from renewable sources.

As strategies not yet correlated with the literature of this text, the novelty of Suez was to address the possibility of negotiating carbon credits, as also considered by Kolk & Pinkse (2004, 2005) and Weinhofer & Hoffmann (2010). The company addressed the majority of strategic drivers listed in Table 2 in its report and is characterized with the strategic profile of “Horizontal Explorers,” according to Table 3, for adopting most of the strategic dimensions focused on climate mentioned by Kolk & Pinkse (2004) and for exploring markets outside its scope of ordinary business, according to Table 3.

### *United utilities*

United Utilities is a water collection and distribution company that also handles waste water collection and treatment in the UK. The calculation of GHG emissions began in the 2000s and, in 2006, the baseline of emissions was defined, enabling the creation of the first carbon strategy in 2007, “which was revised in 2015 with reduction targets of 50% by 2020 and 60% by 2035. [...] Having achieved these targets in 2019 we have reviewed our carbon management strategy and developed a policy which will inform a new strategy to be developed in 2019-20” (Question C0.1 - Figure 3), with expectations of achieving zero net emissions. United Utilities emission measurements are certified in accordance to the ISO 14061-1 (regarding GHG emissions).

Concerns about the company's climate change measures are mainly focused on managing environmental risks such as flooding, freezing, thawing and water contamination, asset and energy failure, which are addressed in its 25-year strategic plan. “Climate change and the resultant changes to weather patterns have the potential to significantly impact our operations and the broader environment and thus impact the long-term viability of the water and wastewater services we provide” (Question C3.1c - Figure 4).

Regarding the adaptations made to address climate change, including those arising from regulations, the company points out that “to mitigate the additional cost to adapt to climate change we have been increasing in renewable energy generation from multiple sources.” (Question C3.1c – Figure 4), which demonstrates the strategic positioning of the organization's climate, similar to the considerations of Cadez & Czerny (2016) and Kouloukoui et al. (2019), when addressing that carbon mitigation strategies are adopted with the purpose of minimizing economic and operational risks and that there is a need for strict legislation to make a transition to a less carbon-intensive society.

The aforementioned cost mitigation strategy was detailed in addressing that the organization invested in its own energy generation through photovoltaic, wind, hydroelectric and biogas facilities, in addition to paying an award in remuneration to the main energy supplier when it comes from a renewable source, which is otherwise not consistent with Cadez & Czerny (2016) consideration of the strategic focus being only on marginal efficiency improvements without significant investments.

The scenario analysis tools used for evaluating the extent of extreme weather events in twenty representative scenarios were the already addressed 2DS and UKCP09, concluding that the company needs to work with third parties to implement sustainable drainage and capture systems. The main strategic driver of United Utilities is risk, be it environmental or physical regulations, as well as a simple perception of an opportunity to reduce operating costs via energy efficiency, used as a means of financial compensation to the adaptations required by climate change (Table 2). Its strategic profile (Table 3) is “Internal Explorers,” due to the effective adoption of energy-efficient technologies aimed at reducing CO<sub>2</sub> emissions.

#### *Veolia Environnement SA*

Veolia is present in more than 60 countries, including Brazil, and provides services for the management of drinking water, waste water and energy, and this paper will focus on its water resources management activities, which represents 42% of the group's revenues. The company highlighted in its report that it offers specialized and innovative solutions to its customers to help them reduce their carbon footprints and integrate the challenges of climate change into their business, when considering the international competitive scenario and environmental regulations.

Energy efficiency in the water cycle was highlighted as a positive factor in its business, ensuring “energy savings of the 5 to 10%, thanks to the optimization of pumping and treatment processes and real time monitoring of consumption” (Question C3.1c – Figure 4). The scenario analysis tool used is the already addressed 2DS, in addition to directing efforts to reduce the GHGs of the regions and countries where it operates, through the required idiosyncrasies and by carrying out partnerships to carry out a scenario analysis through scientific research in partnership with universities.

Few data were presented at the CDP (2019) and, according to them, Veolia's strategic driver is the perception of new business opportunities, specifically by providing water management services to its customers. The strategic profile is that of “Cautious Planners” (Table 3), for not adopting almost any of the climate strategies addressed in the typology of Kolk & Pinkse (2004).

#### *CIA Saneamento de Minas Gerais (COPASA)*

COPASA is the only Brazilian water resources management company that makes its GHG emissions report available at the CDP (2019), however, its position on the matter is:

Although emissions in the sanitation sector are not significant, as they represent only 2 % of emissions of Minas Gerais, COPASA publishes since 2009 its emission inventory, publicly available on the website Fundação Estadual do Meio Ambiente (Question C3.1c – Figure 4).

Through the emissions inventory, the company mentions that it establishes actions and programs that enable the reduction of GHG emissions, without going into details of what these actions and programs are, when meeting the specific laws of the sector in Brazil.

In addition, COPASA's concern is the expansion of water and sewage services in the state of Minas Gerais, due to the historical deficit of the sector, which suggests that the company's focus is the expansion of its business, similar to the consideration of Hoffman (2005) and Kouloukoui et al. (2019), when addressing that many organizations are agnostic about climate change and that the reasons why they adopt policies to reduce greenhouse gas emissions are strategic, in addition to reinforcing the perception of Kouloukoui et al. (2019) of the need for stricter regulations regarding GHG emissions.

The company does not use any scenario analysis tool and did not answer Question C3.1g (Figure 4), which asks why the organization does not use climate-related scenario analysis. No guideline was found regarding the adoption of strategies aimed at climate change, while the company only complies with existing legislation. Due to the company mentioning the possibility of adopting climate-related measures in the future, it is part of the “Cautious Planners” profile, according to Table 3.

#### *American water works*

American Water Works provides public water and sewage services in the United States and highlights that its climate strategies are developed by its R&D sector, in partnership with governmental environment protection agencies and international water research foundations, which results in the development and implementation of solutions aimed at the problems of aging infrastructure, reduction and elimination of leaks, cyber and physical security, and increased resilience of critical assets to climate change.

Their strategic position on climate change is thus predominantly focused on the management of physical (Eleftheriadis & Anagnostopoulou, 2017; Hoffman, 2005) and operational risk (Kolk & Pinkse, 2004), changes in legislation (Rondinelli & Vastag, 1996) and in the economy (Cadez & Czerny, 2016).

In order to ensure that we have adequate water supply, we use long-term planning processes and maintain contingency plans to minimize the potential impact on service caused by climate change and a wide range of weather fluctuations (Question C3.1c – Figure 4).

Despite the ongoing actions aimed at reducing GHG emissions, the company cites the replacement of water pumps and power generators, as well as the construction of new, energy efficient water storage tanks, however, it does not address in detail what reductions will be made, as evidenced in the section below.

After surpassing an ambitious goal to lower our GHG emissions per volume of water produced by 16% over a 10-year period (from 2007 - 2017), American Water set a new goal to reduce GHG emissions by 40% by 2025 (from a 2007 baseline) (Question C3.1c – Figure 4).

The scenario analysis tool used is the 2DS and the RCP 6, in addition to the tool used by the U.S. Army when it works as a client of the organization. The Representative Concentration Pathways (RCP), developed by the Intergovernmental Panel on Climate Change (IPCC), integrates socioeconomic projections of GHG emissions in the scenario analysis and serves for determining climate modeling and chemical standards of the atmosphere (Van Vuuren, Edmonds, Kainuma, Riahi, Thomson, Hibbard, Hurtt, Kram, Krey, Lamarque, Masui, Meinshausen, Nakicenovic, Smith & Rose, 2011). The focus of the American Water Works analysis is sea level rise and flood scenarios.

The organization, according to Table 2, has as strategic drivers physical and regulatory risks, opportunities to improve processes and reputation of the company among its stakeholders, and its strategic profile is “Emergent Planners,” for having established an internal goal of reducing GHG emissions at an early stage consisting on implementing organizational routines to achieve this end.

#### *Aqua america inc.*

The American company Aqua America provides water and sewage management services. The CDP (2019) report analyzed is the first that the company provided, when they committed to reducing carbon emissions. As actions aimed towards this objective, there was the tracking of energy intensity and the establishment of goals aimed at energy efficiency and reduction of operational costs, business opportunities highlighted by Kolk & Pinkse (2004), arising from adaptations to climate change, in this case, by using the adoption of renewable energy sources as an alternative.

Through metrics analysis of water treatment energy intensity using kWh per 1000 gallons in 2018 has produced two results, historical data trends showing energy intensity over time and individual system outliers. [...] Another tracked metric established is water loss, reducing lost water translated to less energy needed for water treatment (Question C3.1c – Figure 4).

The scenario analysis tools used are the previously mentioned RCP (2.6, 4.5 and 8.5), and “are based on a range of possible GHG emissions and can be used to assess the potential impacts of things like extreme weather events, rising sea levels and drought” (Question C3.1d – Figure 4). Once again, there is concern about the physical risks highlighted by Hoffman (2005) and Eleftheriadis & Anagnostopoulou (2017). In addition, Aqua America outlined indicators of its own scenarios to assess the risks of climate change, with the purpose of guiding the company towards adopting policies, regulations and technological changes to address climate change.

Due to the central characteristic of adaptations to climate change being at an early stage, it fits the profile of “Cautious Planners” (Table 3), and its strategic drivers are physical risks and opportunities to reduce operational costs, especially with regard to energy efficiency (Table 2).

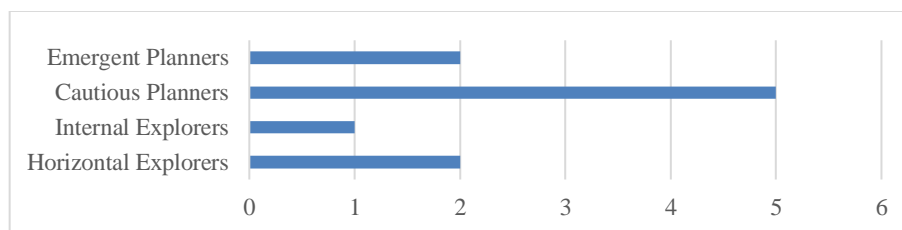


*Cross-case analysis and discussion of the results*

All organizations analyzed in this text provide potable and waste water management services, except for Aqualia, belonging to the Fomento de Construcciones y Contratas group, which provides only potable water management services. As for the strategic drivers for climate change, 80% of organizations have risk drivers, 90% have opportunities and 60% corporate responsibility, while 60% considered the three drivers at the same time. The only company that did not consider any strategic driver focused on climate in its organizational strategy was COPASA, which is also the only Brazilian company analyzed among the cases, as shown in Table 5.

**Figure 6**

*Strategic profiles on climate change of water resource management companies responding to the CDP (2019)*



**Source:** Authors' own elaboration (2020), from Table 5.

The profiles found, summarized in Figure 6, indicated that most water resource management companies fit the profile of Cautious Planners (5 cases), followed by Emergent Planners and Horizontal Explorers (2 cases each) and Internal Explorers (1 case).

Kolk & Pinkse (2005) perception that most companies fit the first two profiles, Cautious Planners and Emergent Planners, remains valid for water resources management companies, as they represent 70% of the cases analyzed (Figure 6). This result indicates that even more than a decade and a half after the publication of the article by Kolk & Pinkse (2005) and 25 years after the enactment of the Kyoto Protocol, water resources management companies are still in the early stages of adaptation to climate change, even if 80% of them envisage the risks involved with climate change, especially changes in environmental legislation, which would require adaptations focused on reducing GHG, and physical risks, which may compromise their operational capacity, such as floods and droughts.

Furthermore, even when acknowledging business opportunities (90% of the cases analyzed), in particular, the reduction of operational costs due to energy efficiency and the development of competitive advantage, as well as the positive impact on organizational reputation (60% of cases) arising from climate change strategies, there are few effective actions done by the water resource management organizations analyzed in the measurement of GHG emissions and the adoption of measures for their effective mitigation, with the ultimate goal of carbon neutrality. Regarding the latter aspect, half of the cases analyzed do not even consider the neutrality of carbon emissions as a goal (Table 5).

The above considerations are in line with the approaches of Eleftheriadis & Anagnostopoulou (2017), that companies need to go beyond the commitment of top management to climate change to succeed in the implementation of climate strategies through the incorporation of climate change risk management procedures in the main activities of the business and the establishment of precise carbon reduction goals, which can be measured through indexes. In addition, they are consistent with the approaches of Cadez & Czerny (2016) and Kouloukoui et al. (2019), who considered regulation as the best driver for engaging companies in actions against climate change.

Water resource management companies provide essential services to the population and are usually in the public domain, so regulations could be directed to the potable water and waste water management sector by local governments as a requirement for maintaining contracts with companies. The main effects of adopting these governmental measures would be two. The first is the imposition of the adoption of carbon mitigation/neutrality strategies in the country, which would contribute to the reduction of the nation's carbon footprint and better compliance with the Kyoto Protocol. The second would reinforce the perception of the risks of changes in legislation targeting the emission of GHGs in the country, which would compel organizations in other sectors to begin their transition to sustainable development as a strategy to reduce operational risks.

As in Kolk & Pinkse (2004), it was also seen that the strategies of water companies regarding climate change are predominantly internal, aimed at improving the energy efficiency of their businesses and that there is a tendency to increase the degree of cooperation between organizations, otherwise, the integration of the supply chain to the climate strategy diverged from the considerations of these authors, given the little exploration of this hypothesis in the cases analyzed. No company among the cases was characterized as Vertical Explorers.

Regarding the integrated and multi-scale water resources management model (Tan & Foo, 2018), it can be observed that companies adopt some more specific tools, such as the adoption of IE (Industrial Ecology), adopting clean technologies to reduce greenhouse gas emissions, such as the companies Anglian Water, FCC, Veolia Environmental and American Water Works. Adoption of the WFE (Water, Food, Energy Nexus) for the inclusion of renewable energy in the most complete system, such as Severn Trent, United Utilities and Aqua America. Adoption of the CE (Circular Economy) in waste management by the company Suez. No adoption of a strategic tool to address climate change by COPASA.

Compensatory measures involving the commercialization of carbon credits were not addressed in the CDP (2019) report in the cases studied. The company Suez raised this possibility in the long term, and adopted initial measures to prepare for it, with regard to measuring the reduction of its emissions. As for the scenario analysis tools used, the most prominent tools were UKCP09 and 2DS (4 cases each), followed by CPR (2 cases) and SRES in a single case. Aqualia uses only its own methodology for scenario analysis and COPASA does not perform scenario analysis but intends to use it in the next two years (Table 5).

**Table 5**

*Cross-case analysis of the strategies regarding climate change of the water resources management organizations of the CDP (2019)*

| ORGANIZATION   | STRATEGIC DRIVERS (Table 2)  | STRATEGIC PROFILE (Table 3) | CO <sub>2</sub> NEUTRAL TARGET (Figure 1) | SCENARIO ANALYSIS TOOL  |
|--|--|-----------------------------|---|---|
| <b>Anglian Water</b>                                       | <ul style="list-style-type: none"> <li>• Risks</li> <li>• Opportunities</li> <li>• Corporate Responsibility</li> </ul> | Cautious Planners           | Yes                                       | <ul style="list-style-type: none"> <li>• UKCP09</li> <li>• SRES A1B, A1FI e B1</li> </ul>         |
| <b>Fomento de Construcciones y Contratas (Aqualia)</b>     | <ul style="list-style-type: none"> <li>• Risks</li> <li>• Opportunities</li> <li>• Corporate Responsibility</li> </ul> | Cautious Planners           | No  | <ul style="list-style-type: none"> <li>• Own methodology</li> </ul>                               |
| <b>Pennon Group</b> (South West Water e Bournemouth Water) | <ul style="list-style-type: none"> <li>• Risks</li> <li>• Opportunities</li> <li>• Corporate Responsibility</li> </ul> | Emergent Planners           | Yes                                       | <ul style="list-style-type: none"> <li>• UKCP09</li> </ul>  |
| <b>Severn Trent</b> (PLC, Water e Services)                | <ul style="list-style-type: none"> <li>• Risks</li> <li>• Opportunities</li> <li>• Corporate Responsibility</li> </ul> | Horizontal Explorers        | Yes                                       | <ul style="list-style-type: none"> <li>• UKCP09</li> </ul>  |
| <b>Suez</b>  | <ul style="list-style-type: none"> <li>• Risks</li> <li>• Opportunities</li> <li>• Corporate Responsibility</li> </ul> | Horizontal Explorers        | Yes                                       | <ul style="list-style-type: none"> <li>• 2DS</li> </ul>   |
| <b>United Utilities</b>                                    | <ul style="list-style-type: none"> <li>• Risks</li> <li>• Opportunities</li> </ul>                                     | Internal Explorers          | Yes                                       | <ul style="list-style-type: none"> <li>• 2DS</li> <li>• UKCP09</li> </ul>                         |
| <b>Veolia Environnement SA</b>                             | <ul style="list-style-type: none"> <li>• Opportunities</li> </ul>  | Cautious Planners           | No  | <ul style="list-style-type: none"> <li>• 2DS</li> </ul>   |
| <b>Cia Saneamento de Minas Gerais – COPASA</b>             | <ul style="list-style-type: none"> <li>• None</li> </ul>   | Cautious Planners           | No  | <ul style="list-style-type: none"> <li>• Does not use</li> </ul>                                  |
| <b>American Water Works</b>                                | <ul style="list-style-type: none"> <li>• Risks</li> <li>• Opportunities</li> <li>• Corporate Responsibility</li> </ul> | Emergent Planners           | No  | <ul style="list-style-type: none"> <li>• 2DS</li> <li>• RCP 6</li> </ul>                          |
| <b>Aqua America Inc.</b>                                   | <ul style="list-style-type: none"> <li>• Risks</li> <li>• Opportunities</li> </ul>                                     | Cautious Planners           | No  | <ul style="list-style-type: none"> <li>• RCP 2.6</li> <li>• RCP 4.5</li> <li>• RCP 8.5</li> </ul> |

Source: Authors' own elaboration (2020).

### Closing remarks

Based on the objective of identifying the strategic profiles from the classification by Kolk & Pinkse (2005) of the ten water resources management companies that are part of the CDP (2019), through multiple case studies and qualitative data analysis, it was found that, although more than 15 (fifteen) years have passed since the publication of the article, the strategic profiles identified by the authors still serve to categorize the climate change strategies of the companies that respond to the CDP (2019).

The main contributions of this study are: a) most of the water resource management organizations of 2019 analyzed fit the profiles of Cautious Planners and Emergent Planners; b) the main strategic drivers for climate change are opportunities, risks and corporate responsibility, in this order; c) the perception of Cadez & Czerny (2016) and Kouloukoui et al. (2019) that regulation is the best means to engage companies in actions to address climate change is reinforced; d) the adoption of stricter legislation on CO<sub>2</sub> emissions for organizations focused on the provision of water and sewage services can contribute both to reducing the country's carbon footprint and to directing companies in other sectors to start the transition to a less carbon-intensive society; e) the commercialization of carbon credits is not a strategic focus of water resource management companies.

The scenario analysis tools adopted by water resources management companies were only identified and described in this study, so we recommend that future studies be carried out identifying the driving and limiting factors of each of them in business strategies to address climate change. We also recommend carrying out new studies that replicate the methodology used in this research in other sectors, due to the idiosyncrasies of the business areas highlighted by Lee (2012), in order to enable the comparison of climate strategies in different areas, especially regarding carbon-intensive activities. Case studies aimed at analyzing and discussing the motivation and the process of strategic decisions of companies and governments to address climate change are also possibilities for future research.

Finally, the limitations of this article are that it used as a case study only companies responding to the CDP (2019) questionnaire, as well as the use of voluntary information given to this database and the case study method itself.

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