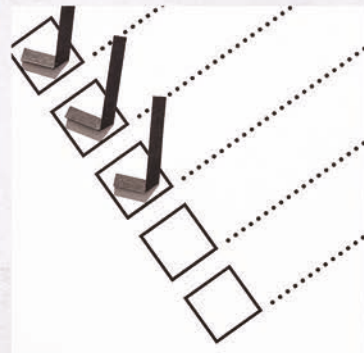


RESILIENT INDUSTRY

AN INDUSTRY GUIDE:
ADAPTING TO THE IMPACTS
OF CLIMATE CHANGE
- GENERAL GUIDELINES



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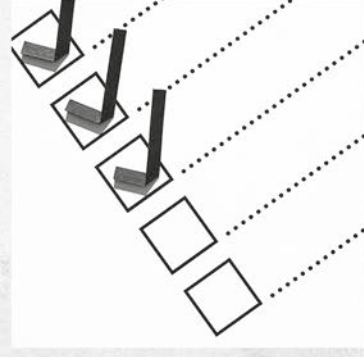
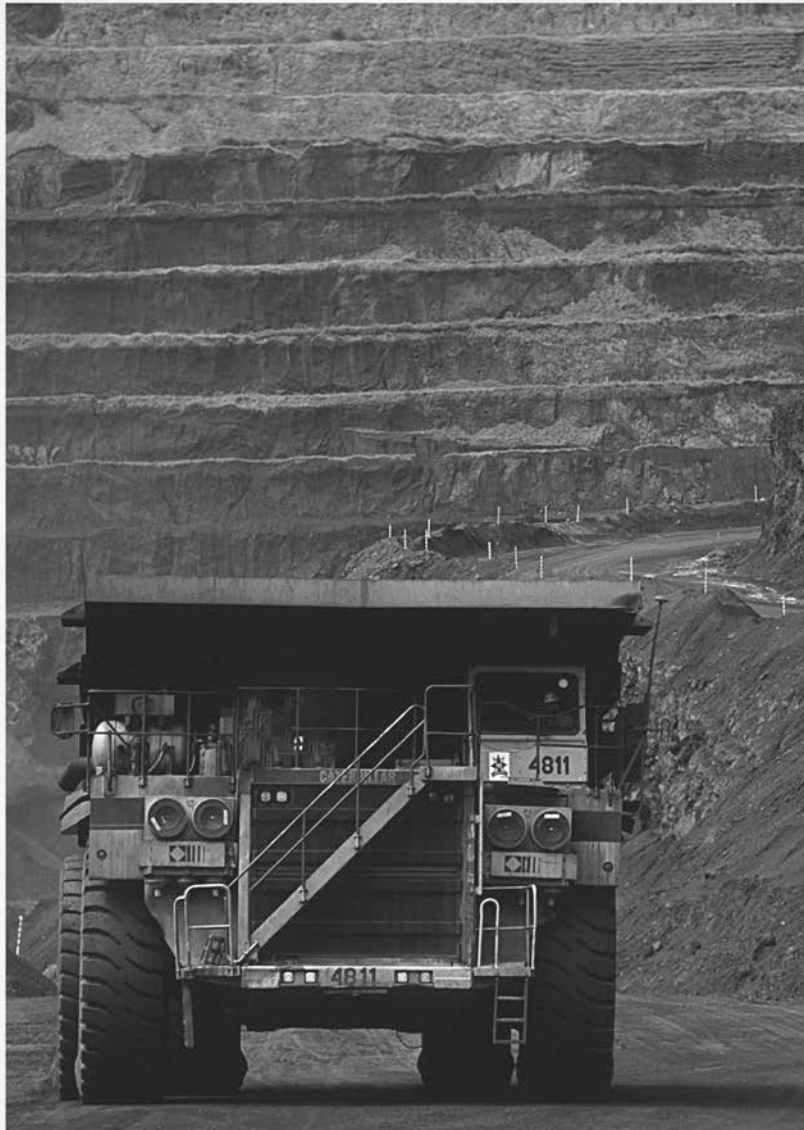
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INTRODUCTION

Extreme events arising from the impacts of climate change, such as floods, heat and cold waves, windstorms, landslides and droughts, are reshaping the business environment. They result in several detrimental effects on economic activity, infrastructure and health. The industry's production chain is mainly affected by the lack of energy supply at competitive prices, the risk of water shortages and damage to assets, in addition to the increase in insurance policy costs.

The *Economics of adaptation* report, released by the World Bank, estimated an annual global loss between US\$ 77.6 billion and US\$ 89.6 billion due to extreme weather events until 2050. Between 1995 and 2014, the Center for Studies and Research into Engineering and Civil Defense (CEPED), of the Federal University of Santa Catarina (UFSC), reported R\$ 4.2 billion in economic losses for the Brazilian industry due to climate change.

To alleviate this situation and open up new opportunities, we must promote the incorporation of climate risk management into the strategic planning of companies. This process should take place by preparing business plans for adapting to climate change, which will allow the industry's production chain to minimize potential economic losses, increase its competitiveness and develop new products and services that are more resilient to weather effects.

For this reason, the Brazilian National Confederation of Industry (CNI), in partnership with the Federation of Industry of the State of Santa Catarina (FIESC), through the Santa Catarina Industry Sustainability Plan, presents this guide to support companies in formulating their plans. The guide adapts the internationally consolidated methodology to the reality of the national industry. This is done by incorporating concepts into the quality and risk management tools already in use, in order to nurture a climate risk prevention culture in the production chain.

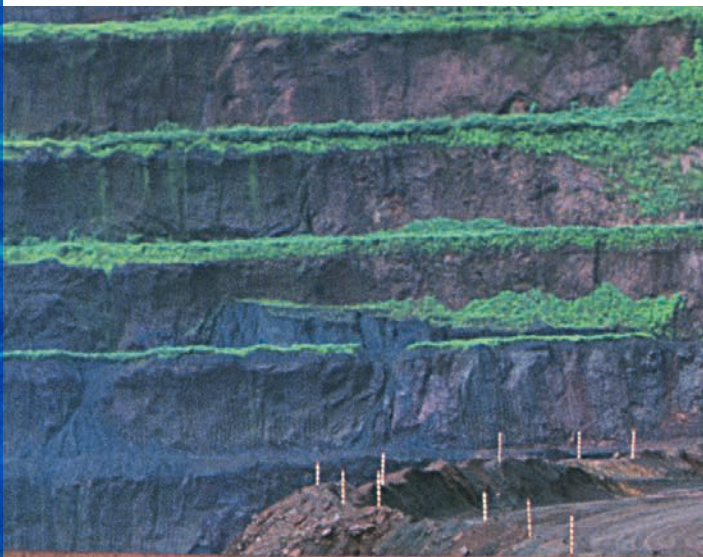
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Robson Braga de Andrade

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1 WHY MUST THE INDUSTRIAL SECTOR ADAPT TO CLIMATE CHANGE?



Climate change is among the most complex challenges of this century and no country, city, person or business is immune from its effects. This change is already reshaping the business environment by changing the patterns of weather elements, notably temperature and precipitation, causing an increase in the frequency and magnitude of extreme weather events, such as floods, heat and cold waves, landslides, droughts among others. These extreme events result in damages and losses to economic activities, infrastructure, health, as well as the natural system.

The impacts of extreme events are very detrimental to all of society:

- Banco Itaú reports that, in 2016, natural catastrophes resulted in losses in the order of **US\$ 50 billion** for property and personal insurance - **11% more than in the last 10 years** (ITAÚ, 2017).
- In the “*Global Catastrophe Recap: January 2020*” report, Aon stated that, from January 17 to 29, 2019, Brazil sustained losses of **R\$ 892 million** caused by flood events, which also resulted in 70 deaths (AON, 2020a).
- Globally, the report “*Weather, Climate & Catastrophe Insight: 2019 Annual Report*” indicates the occurrence of 409 natural disasters, resulting in economic losses of **US\$ 232 billion**, of which only **US\$ 71 billion** was covered by insurance companies¹ (AON, 2020b).

¹ This scenario points to the importance of industries considering the increase in insurance premiums as a risk, since, with the trend of increasing extreme weather events, the costs of insurers and reinsurers will also tend to grow and be passed on to the industrial sector (CNI, 2019).

- Regarding the industrial sector, the report on material damages and losses resulting from natural disasters in Brazil from 1995 2014 by the Center for Studies and Research into Engineering and Civil Defense (CEPED) of the Federal University of Santa Catarina (UFSC) indicates there were 1,848 events, totaling a loss of **R\$ 4.2 billion**. This refers only to the losses reported by the industry and may be much higher (CEPED, 2016).

From the point of view of investments in measures to adapt to climate change, a survey by the *Climate Policy Initiative*, an entity that consolidates investments in low carbon throughout the world, showed in the report “*Global Landscape of Climate Financing*” that there was a boost of **35% in 2017 and 2018 (US\$ 30 billion) compared to 2015 and 2016 (US\$ 22 billion)**. This increase points to the growing importance of climate resilience, the urgency to build adaptive capacity and manage vulnerabilities to climate change. It should be noted that most of the financial reports presented came from public entities (CPI, 2019).

1.1 IMPACTS ON INDUSTRY - RISKS AND OPPORTUNITIES

The industry is already being affected by the impacts of extreme weather events. In addition to affecting business competitiveness (lack of a secure energy supplies at competitive prices, risk of water shortages, damage to company assets and infrastructure, among others), businesses still need to deal with the increased prices of operational insurance policies and impacts on the availability of workers, as they are also affected by climate change (BRAZIL; CNI, 2018).

The impacts of climate risks to different economic sectors will be greater according to the how sensitive these sectors are to impacts.,. Conversely, this sensitivity decrease as economic sectors become capable of adapting to these impacts. For the industry, these differences will manifest according to the sector, region and size of the companies. The most sensitive sectors are those that water and energy more intensely, those located in the most vulnerable regions (e.g., coastal areas and places subject to flooding or landslides) and those dependent on infrastructure operated and maintained by third parties. These risks can also emerge indirectly, especially for sectors with a closely-connected production chain and/or sectors that are dependent on the most vulnerable links in the value chain, and are, therefore, more vulnerable to climate threats that can't be managed directly.

Thus, when considering how the industry may adapt, we must consider not only the direct impacts on operations, but also the indirect impacts on the infrastructure its production chain relies on (BRAZIL, 2016b).

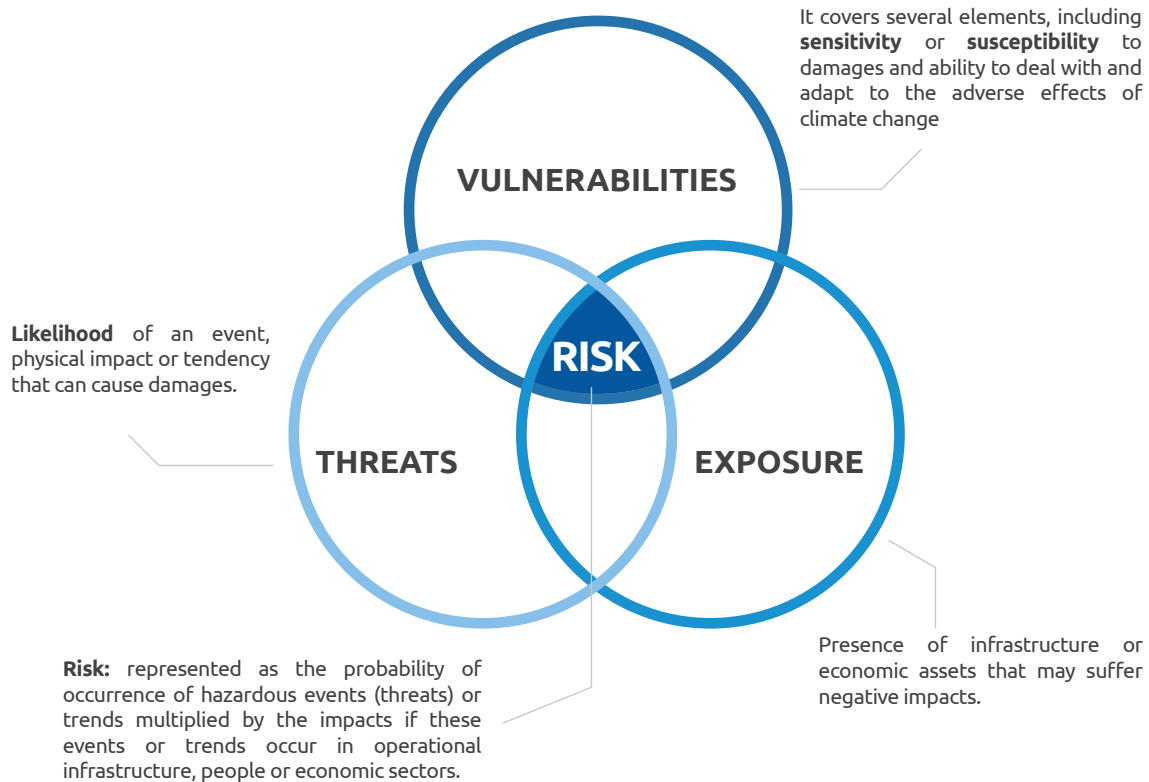
According to the Brazilian National Plan for Adaptation to Climate Change (PNA), the impacts made by climate change on the industrial sector can be classified as biophysical and socioeconomic (BRASIL, 2016b). Table 1 shows examples of these impacts.

TABLE 1 – Vulnerabilities and impacts for the industrial sector according to its exposure to climatic phenomena and extreme events

EXPOSURE	VULNERABILITIES	POTENTIAL IMPACTS	
		Socioeconomic	Biophysical
Extreme climate phenomena	<ul style="list-style-type: none"> Industrial and mining sites located in regions of elevated topography susceptible to landslides or in low parts of the relief, subject to flooding; Industrial parks and mining sites far from warehouses; Industrial and mining sites with water intake concentrated in public distribution networks and whose energy matrix suffers from low diversification (high dependence on distribution networks); and Industries with little investment in the adaptation of industrial sites (including buildings and equipment) and in research and development. 	<ul style="list-style-type: none"> Reduced availability and quality of water; Reduced availability of raw materials and supplies; Decrease in thermal comfort, quality and safety of the work environment; Human resource impairment; Damage to industrial infrastructure (mines, buildings, machinery, etc.); Damage to logistics infrastructure (roads, waterways and ports); and Damage to energy and telecommunications infrastructure. 	<ul style="list-style-type: none"> Increase in operational, investment and insurance costs; Decreased or interrupted production; Loss of production; Loss of competitiveness; Decrease in the capacity to create jobs and generate revenue; and Impaired logistics.
Gradual weather events	Rise in sea level	<ul style="list-style-type: none"> Potential loss of water intake and quality; Oxidation of metallic structures and equipment; and Damage to port structure. 	
	Change in weather patterns	<ul style="list-style-type: none"> Industrial and mining sites located in vulnerable regions or regions dependent on agricultural, forestry or biodiversity raw materials. 	<ul style="list-style-type: none"> Reduction or interruption in the provision of raw materials; and Decrease in thermal comfort, quality and safety of the work environment.

Source: Prepared in-house in BRAZIL (2016b).

For industries to be ready to face potential impacts, businesses should know how to assess climate risks. Doing so will allow them to understand any current and future risks. According to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), there are three key elements involved in risk analysis: threat (dangers related to climate risks - floods, droughts, heat waves, etc.), exposure (location and its characteristics – industry assets) and vulnerability (sensitivity or susceptibility and responsiveness - characteristics that are specific to industries) (IPCC, 2014).

FIGURE 1 – Climate risk analysis

Source: Prepared in-house from the IPCC (2014).

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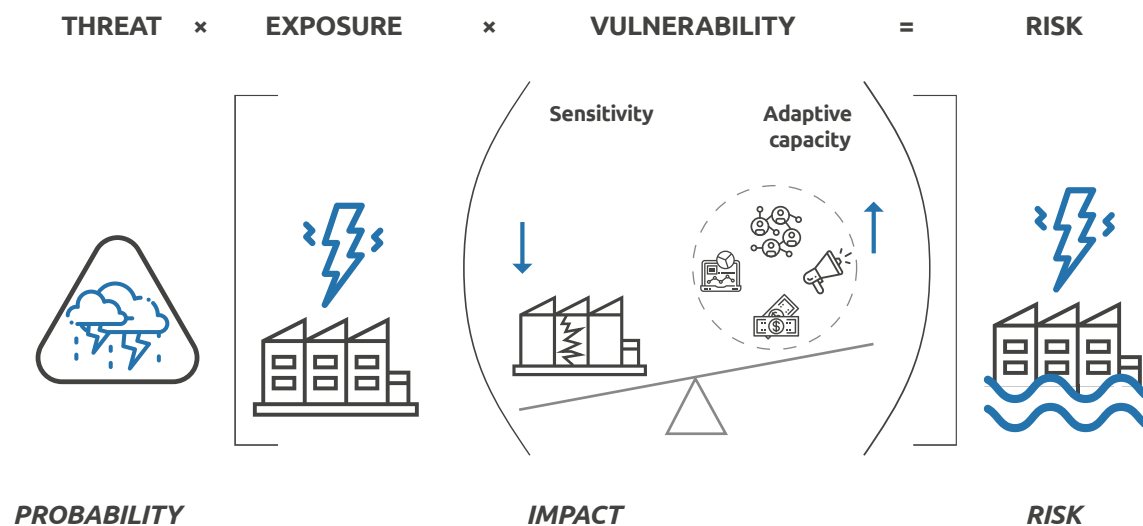
ADAPTIVE CAPACITY: the ability of systems, institutions, people and other organisms to adjust to possible damages, know how to seize opportunities or respond to consequences (IPCC, 2014). According to FMECD (2014), the key dimensions of adaptive capacity are:

- **Knowledge:** refers to general levels of education and awareness about issues such as climate change and its impacts, as well as distribution of information on climate and weather conditions.
- **Technology:** includes availability and access to technological resources for the purposes of adaptation and the technological advancement in the development of a system.
- **Institutions and Organizations:** covers the many layers of governance, institutions and legal bodies, including the capabilities and efficiency of key institutions, enforcement of environmental laws, transparency of procedures and decision-making. This dimension could also include responsibility and practices to ensure sustainable management of natural, financial and human resources.
- **Economy:** comprises existing economic and financial resources that can improve the adaptive capacity or help implement adaptational measures.

SENSITIVITY: people's physical predisposition, as well as infrastructure and environment that may be affected by a dangerous phenomenon due to lack of safety measures (IPCC, 2012). In other words, sensitivity refers to the intensity at which a system can suffer damage or be affected by dangerous phenomena. This intensity is determined by the system's intrinsic susceptibility.

Thus, the climate risk analysis involves a combination of the likelihood of a climate threat and its impact, considering the exposure and vulnerability of a given industry. As an example, let's consider an industrial company that is heavily dependent on water and is located in a region where there is a high probability of reduced rainfall (the referred company does not have a water storage system). The company will suffer from greater impact and, as a result, will face greater risks compared to another company, who implemented a water storage system, located in the same region. Figure 2 illustrates the relationship between the likelihood of the climate threat and the impact related to exposure and vulnerability.

FIGURE 2 – Examples of threats, exposure and vulnerability in the industrial sector



Source: Prepared in-house from the IPCC (2014).

With this in mind, we can work on the early implementation of corporate adaptation measures that let us reduce the cost associated with future losses and damages, as well as the identify opportunities to develop new services, expand markets and build climate resilience.

To help us understand the existing types of adaptation, table 2 below shows the categories and subcategories, as well as some examples that can be applied in the industrial sector.

TABLE 2 – Categories of adaptive measures and examples applied to the industrial sector

CATEGORY	EXAMPLES APPLIED TO THE INDUSTRIAL SECTOR
Structural/ Physical	Built environment options: breakwaters and coastal protection structures; flood dams; water storage; flow improvements; civil construction; rainwater and wastewater management; improvements in transport and road infrastructure; and cooling systems.
	Technological options: energy efficiency; efficient water use technologies; desalination; mapping and monitoring of hazards and vulnerabilities; warning systems; building insulation; mechanical and passive cooling; and technological development, transfer and distribution.
	Ecosystem-based options: ecological restoration; soil conservation; reforestation; conservation and replanting of swamp vegetation; ecological infrastructure (e.g., shade trees, ecological cover); and community-based natural resource management.
Economic	Economic options: financial incentives; insurance; compensation in case of catastrophe; payments for ecosystem services; micro finance; disaster contingency funds; transfers of financial resources; and public-private partnerships.
Institutional	Government and national programs and policies: national and regional adaptation plans, including their integration; subnational and local adaptation plans; disaster planning and preparedness; integrated water resources management; integrated coastal zone management; ecosystem-based management; and community-based adaptation.
Social	Services: social safety nets and social protection; food banks and food surplus distribution.
	Educational options: participatory measure research and social education; knowledge sharing and learning platforms.
	Informational options: hazard and vulnerability mapping; disaster warning and response systems; systematic monitoring and remote sensing; climate services (provision of scientifically credible information and knowledge about climate and meteorology); and scenario development.
	Behavioral options: worker evacuation planning, migration; partnerships and transparent and close communication with stakeholders.

Source: Prepared in-house from the IPCC (2014).

The general process of adapting the industrial sector to climate change will open up opportunities to increase efficiency, develop new technologies and new markets. Changes in existing facilities and production processes, relocation of factories, among others, can be mitigated if climate risk is properly managed, with possible economic gains, strengthening the competitiveness of the industrial sector and its production chains, in addition to increasing climate resilience² (BRAZIL; CNI, 2018).

² Resilience - Ability of social, economic and environmental systems to deal with a dangerous event, trend or disturbance, respond or reorganize so as to maintain their essential function, identity and structure and, at the same time, maintain the capacity to adapt, learn and transform (IPCC, 2014).

BUSINESS CLIMATE RESILIENCE

According to the study “Climate resilience in Latin America’s value chains”, carried out by WayCarbon in partnership with the *Carbon Disclosure Project* (CDP) and published in 2018, most companies in Latin America are not ready to face the adversities of climate change, and those that are or are trying to be, certainly are or will be ahead of the market and will stand out as a result. (PEREIRA, 2018).

PURPOSE Assess the climate resilience of Latin American value chains through the development of the climate resilience index.

SUMMARY: Based on the information collected from 755 companies located in Latin America, in 2017, through the CDP *Supply Chain* initiative of 2017, we were able to obtain data on the maturity of the climate management programs of such companies. As this information in itself is not enough to assess how companies are exposed to climate change, as the information does not consider the location of the companies, WayCarbon identified the location itself, in order to carry out an integrated assessment of the data. This assessment consisted of an analysis of data from the *Climate Management Maturity Index* (CCMI), together with an analysis of companies’ vulnerability to climate change adversities, resulting in the climate resilience index.

RESULTS:

- Of the 654 companies analyzed, 34% (222) are classified as resilient or strategists, that is, they have some type of effective management to face climate-related impacts. Of these, 77 are located in Mexico;
- 164 companies were considered vulnerable, with the majority (49%) located in Mexico, followed by Brazil (23%);
- In Brazil, 64% of companies have low level of climate management maturity. The numbers in Mexico are a bit smaller in comparison, but high nonetheless: 55% of companies have low maturity. This indicates that these companies have not quantified their greenhouse gas (GHG) emissions or have not assessed climate risks at any level.

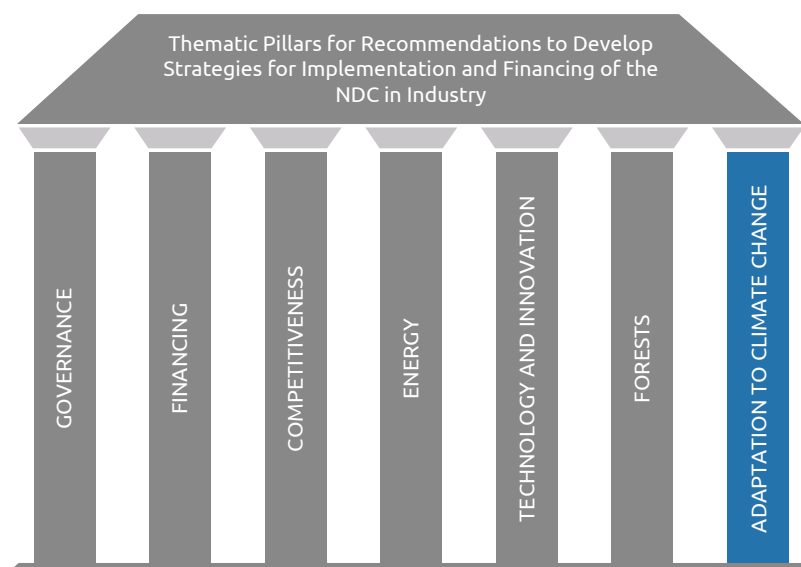
1.2 POLICIES, PLANS AND REGULATIONS

In 2015, the most important global agreement to combat climate change, the Paris Agreement, was presented during the 21st Conference of the Parties (COP 21), held in France. Brazil made commitments through its Nationally Determined Contribution (NDC) with the goal of reducing 37% of greenhouse gas (GHG) emissions and the indicative contribution of 43%, in relation to levels seen in 2005, along with additional measures in the fields of energy, forestry and agriculture. With regard to adaptation, the Paris Agreement points to the need to enhance the ability of countries to prepare for the negative impacts of climate change and to encourage the strengthening of resilience.

Brazil has been working on the development of new policies, based on the Brazilian National Plan for Adaptation to Climate Change (PNA), which is, in turn, based on the Brazilian National Policy on Climate Change (PNMC). The PNA is an instrument developed by the federal government in collaboration with civil society, the private sector and state governments, aiming to promote the reduction of Brazil’s vulnerability to climate change and to manage the climate risk. The plan includes 11 economic sectors, one of which is “Industry and Mining”, in which the basic guidelines complement the sections about adaptation to climate change in the Industry Plan and in the Low Carbon Mining Plan, highlighting the transversality of the necessary actions and the existing gaps (BRAZIL, 2016b).

The Brazilian National Confederation of Industry (CNI) understands the importance of combining economic growth and sustainability and has been working with the federal government to implement and finance the Brazilian NDC. In this sense, recommendations were structured based on seven thematic pillars, which cover the set of needs of the industry's production chain (CNI, 2018).

FIGURE 3 – Thematic pillars for making recommendations to implement and finance the Brazilian NDC in the industrial sector



Source: CNI (2018).

The recommendations in pillar 7, "Adaptation to Climate Change", point out the needs of the industrial sector and qualify the development of strategies to implement the PNA's guidelines for the industry and mining sector and their interfaces, in order to contribute towards consolidating the national climate change adaptation strategy (CNI, 2018).

In addition to policies and plans related to adaptation to climate change at the national level, we must also consider the existing international standards, as they are an important tool to help us integrate the climate actions needed to consolidate a low-carbon economy that can be resilient to the impacts of climate change. The *International Standards Organization* (ISO) has two regulations related to adaptation to climate change, namely ISO 14090:20193 "Adaptation to climate change - Principles, requirements and guidelines" and ISO/DIS 14:091 "Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment", which is currently being prepared.

3 Additional information available at: <<https://www.iso.org/obp/ui/#iso:std:iso:14090:ed-1:v1:en>>. Accessed on: August 04, 2020.

ISO FAMILY on climate change adaptation

ISO 14.090:2019 - Adaptation to climate change - principles, requirements and guidelines:

This standard aims to provide organizations with a consistent, structured and pragmatic approach to prevent or minimize the damage caused by climate change, while also helping take advantage of the opportunities presented by these changes. This is still applicable to any organization, regardless of size and type, such as local, regional, international, business units, conglomerates, industrial sectors and natural resource management units. By enforcing it, companies can help demonstrate to stakeholders that an applied approach to adapting to climate change is credible, as the document was conceived to help organizations develop measures and report on adaptation practices in a verifiable manner.

Generally speaking, ISO 14.090:2019 describes the following elements, which must be considered in the climate change adaptation plan:

- Pre-planning;
- Assessment of impacts, including opportunities;
- Adaptation planning;
- Implementation;
- Monitoring and evaluation; and
- Reports and communication.

ISO/DIS 14.091 - Adaptation to climate change - guidelines for vulnerability, impacts and risk assessment:

Encompassed ISO 14.090, ISO/DIS 14.091 (under development) is part of the second stage described above: “**assessment of impacts, including opportunities**”. This standard can be used by any organization, regardless of type and size. This means that organizations will be able to collaborate with financial institutions when making decisions on project finances, business sectors or local governments in developing adaptation strategies, as well as companies operating in climate-vulnerable areas.

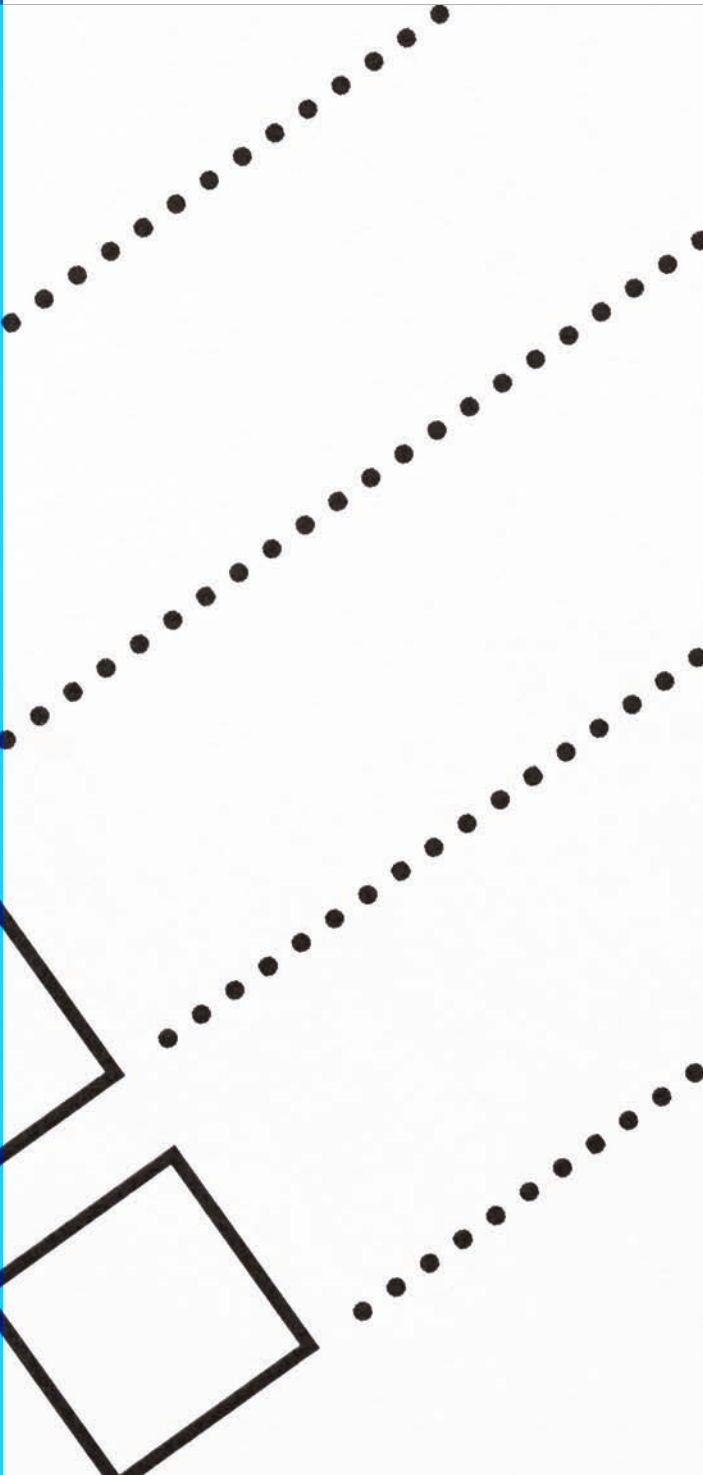
This document should be applied by organizations wishing to carry out risk assessments in line with the Fifth Assessment Report (AR5) of the IPCC.

Remarks: There are other ISO standards that also address climate change or are in some way related to ISO 14.091. One example is **ISO 31.000:2018 - Risk Management**, as it helps organizations manage the risks identified and assessed in ISO 14.091 (expands the limitation of the risk assessment of ISO 31000). Another example is **ISO 14.001:2015 - Environmental Management System**, which helps integrate climate change adaptation into an environmental management system, using ISO 14.091 as a source of additional information to support this.

One of the crucial points for the practical implementation of the actions mentioned in the above standards refers to preparing a climate change adaptation plan. This plan allows the industry to survey, manage and prevent climate risks, making its assets more likely to receive investments from the market, for example.

There are several models that can be used to prepare a climate change adaptation plan. This guide will cover the methodology of the *United Kingdom Climate Impacts Program* (UKCIP), a tool adapted by the Center for Sustainability Studies of the Getúlio Vargas Foundation (FGVces) and suggested by the Ministry of the Environment (MMA), for the development of business adaptation strategies by the private sector. However, it should not be treated as the sole tool for developing a climate change adaptation plan. Companies can use it with the aforementioned international standards to help them better understand the subject and become better prepared to face the impacts of climate change.

Thus, CNI aims to use this guide to outline the UKCIP methodology, knowing that the industry should be prepared to adapt to climate impacts. CNI also aims to outline the quality and risk management tools used in the industrial sector, in order to contribute to **the creation of a climate risk prevention culture in the production chain**. The objective is to provide instruments that will help companies formulate their own plans to adapt to climate change, ensuring greater operational reliability, strategic importance and increased industrial competitiveness.



2 WHAT IS AN ADAPTATION PLAN?



A climate change adaptation plan brings together a set of strategies that seek to improve or introduce the management of climate opportunities and risks, reduce potential economic losses and increase climate resilience. As each industry has specific characteristics, including in terms of adaptive skills, it is important that they develop their own strategies, based on what the risks and opportunities of climate change mean for their businesses.

In order to develop a robust climate change adaptation strategy, all internal actors and external partners must be involved since each one may have specific knowledge. This makes it necessary to engage all parties involved from the initial stages, clarifying the importance of developing adaptation strategies for business sustainability.

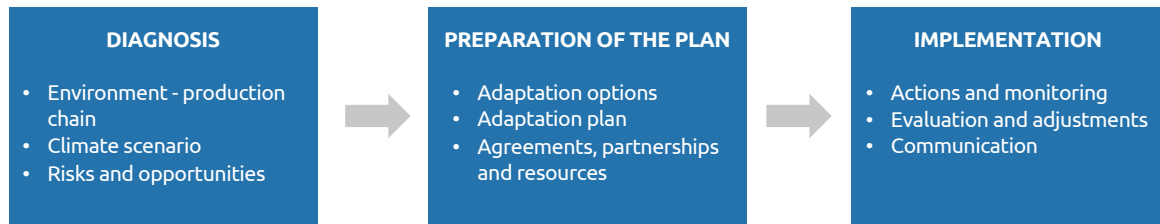
This chapter presents the theoretical framework and the general phases involved in building a climate change adaptation plan, as well as the importance of incorporating this plan into risk and operational routine management systems.

2.1 PROCESS AND CONTENT IN IN PREPARING AN INDUSTRY ADAPTATION PLAN

Different international institutions have different models for preparing climate adaptation plans for different economic sectors, governments, regions, etc. Almost all of them share the central basic elements. This guide uses the model developed by the UKCIP, which was adapted by FGVces for use in Brazil.

The basic model proposed for the preparation of an adaptation plan consists of three phases: (i) diagnosis; (ii) preparation ; and (iii) implementation. Each of them consists of three steps, as discussed below.

FIGURE 4 – Phases for preparing the climate change adaptation plan - UKCIP methodology



Source: Prepared in-house from GVces (2015).

2.1.1 DIAGNOSIS

This initial phase consists of surveying the company's internal and external conditions and mapping the risks and opportunities. It involves surveying the available information about present, past and future situations, possible climate change threat scenarios for industrial companies, the risks of impacts to be faced and potential opportunities to be explored. Ideally, **measure should be developed to engage the company's internal and external parties.**

Environment - production chain

- **Concept:** this stage defines the objective and scope of the company's strategy to adapt to the impacts of climate change. Considering that the impact of climate risk on the environment directly affects the internal production process of industrial businesses in some cases, the analysis of the environment must take into account, at the company's discretion, the production chain in the scope of the adaptation strategy, **including the main supply channels, operations and product distribution, as is relevant to the business.**
- **Objective and scope:** this stage identifies the scope, target audience, objectives, barriers and motivations for the company to implement a strategy that adapts to the impacts of climate change. Industrial companies with environmental and/or risk management systems tend to cope better with possible climate risks that can threaten people and the environment, as well as the company's reputation, facilities or production. The risks should also be minimized in cases where the company's management is actively committed towards solving the issue at hand.

- **Parties responsible:** multidisciplinary team designated to coordinate and prepare the climate change adaptation plan. Senior management should also be involved from the beginning of the project.

Climate scenario

- **Concept:** this stage involves understanding the possible impacts caused by climate change on the industrial company in the past, present and future.
- **Objective and scope:** survey and analyze climate events and their past, current and potential future impacts that the company may face, and select the climate scenarios that will help the company during the planning and decision-making processes. This stage is primarily technical in nature and is related to climate science. It also presents the uncertainties of future climate forecasts (scenarios) inherent in the models, and how these scenarios may translate into real threats for companies (plants, sectors or production chains). These scenarios include floods, landslides, disruption of services, etc.
- **Parties responsible:** field dedicated to coordinating and preparing the climate change adaptation plan. External support will be sought to develop a specific technical study that outlines a range of likely climate scenarios. Companies should involve fields that know and deal with past, present and potential future impacts related to extreme events, as well as company sectors that can contribute towards identifying studies and scenarios and interpreting information for the context of the business.

Risks and opportunities

- **Concept:** this stage involves understanding the magnitude of the risks associated with the impacts of climate change and understanding the exposure and vulnerability of operations in the industry's production chain. Based on this, companies should prioritize risks and opportunities that may arise. Risks should be treated as all factors that threaten the company's physical integrity and reputation, and potential economic losses, such as the production stoppage due to flooding or landslides, the interruption of water and energy supplies or transport, the lack of supply of raw materials, etc. The opportunities are related to the skills required for technological innovation, efficiency gains and the development of new products and markets.
- **Objective and scope:** identify and prioritize the risks and opportunities to which industrial operations and their production chain are subject, based on an environmental diagnosis in this production chain and possible climate scenarios. This involves a holistic analysis, taking into account all categories of the impact of climate risks: operational, environmental, reputational, financial and regulatory impacts, as well as impacts on the market and on the value chain. It is important

to emphasize that the uncertainties of climate scenarios suggest that decisions to face the risk (adaptation) may not always be certain. It is important to balance costs, benefits and the probability events⁴.

- **Parties responsible:** field dedicated to coordinating and preparing the climate change adaptation plan while consulting other sectors of the industrial production chain that are subject to the mapped risks and opportunities.

LEARN MORE

To learn more about scenarios, future climate impacts and adaptation cases, please visit:

- IPCC:
 - <https://www.ipcc.ch/>
 - https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter12_FINAL.pdf
- Brazilian Panel on Climate Change (PBMC):
 - http://www.pbmc.coppe.ufrj.br/documentos/RAN1_completo_vol2.pdf
 - <http://www.pbmc.coppe.ufrj.br/index.php/pt/>
- Ministry of the Environment (MMA):
 - Adaptaclima - <http://adaptaclima.mma.gov.br/>
 - Educaclima - <http://educaclima.mma.gov.br/mudanca-do-clima/>
- WeADAPT - <https://www.weadapt.org/>
- UN Environment - Global Adaptation Network - <https://www.unenvironment.org/gan/>
- UNEP Finance Initiative - Charting a New Climate - <https://www.unepfi.org/wordpress/wp-content/uploads/2020/09/Charting-a-New-Climate-UNEP-FI-TCFD-Banking-Physical-Risk.pdf>

For data from Brazilian climate models, please visit:

- International context:
 - Set of IPCC's global and regional models: <https://esgf-index1.ceda.ac.uk/projects/esgf-ceda/>
- Brazilian context:
 - Brazilian National Institute for Space Research (INPE): <http://www.inpe.br/>
- Brazilian National Institute of Meteorology (INMET)
 - Observed climate data - <https://portal.inmet.gov.br/>

2.1.2 PREPARING THE PLAN

Based on the diagnosis of the company's internal and external situation, the climate risks and the opportunities it will eventually be exposed to, the company will begin to substantively prepare the adaptation plan, which also involves three steps: (i) choosing the adaptation options; ii) preparing the adaptation plan; and (iii) establishing agreements and partnerships and raising the necessary funds. The company should also develop a **communication strategy for seeking external agreements and partnerships**.

⁴ Tables 1 and 2 presented in this document can be consulted at this stage.

Adaptation options

- **Concept:** this stage involves the surveying measures that seek to minimize the risks and possible impacts of climate change and enhance opportunities. Roughly speaking, these measures can be classified as “*hard*”, which are physical measures such as engineering, and “*soft*”, which are related to management, information, change in organizational culture, etc. *Soft* measures tend to be cheaper, but they require political will, leadership and a commitment to bring about change. Engineering measures, on the other hand, vary in costs and must be analyzed on a case-by-case basis.
- **Objective and scope:** identify effective adaptation measures to minimize different risks and threats and measures that are feasible for realistic implementation.
- **Parties responsible:** areas and sectors of the industrial production chain identified under the mapped risks must be involved to point out appropriate adaptation measures (according to climate scenarios, risks and potential opportunities). All evaluated and approved adaptation measures must be reported to the team responsible for coordinating and preparing the adaptation plan.

At this stage, it may be worthwhile to consult some of the external partners present in the location(s) covered by the adopted scope, as they may suggest potential adaptation measures that had not yet been considered.

Adaptation plan

- **Concept:** the adaptation plan contains the identified adaptation measures, ordered according to implementation priorities, deadlines, costs and responsibilities of the different actors.
- **Objective and scope:** define which prioritization criteria should be adopted - such as effectiveness of measures, costs and benefits, financial capacity, company and/or social acceptability, indirect gains, etc. Define a script for implementation of the plan - what to do, parties responsible, deadlines, goals, investments, source of the financial resources, how and where the operation will be carried out.
- **Parties responsible:** team responsible for preparing and coordinating the adaptation plan. The leaders should be involved, as they are responsible for validating the plan. This step is crucial for moving forward with the implementation of the adaptation plan.

Agreements, partnerships and resources

- **Concept:** this stage involves factors that aim to make up for any deficiencies in each industrial company in terms of knowledge; resources, technical, institutional and managerial capacity, etc.
- **Objective and scope:** to improve the quality and enable the implementation of the adaptation plan. Partnerships for all actions are always desirable for clear reasons, especially when climate risk affects an entire region, businesses or local communities, which may have the same adaptation incentives. Likewise, companies should be informed about financing alternatives, including cost sharing between public and private authorities.
- **Parties responsible:** team responsible for preparing and coordinating the adaptation plan, institutional relations and the communication department. The suggestion here is to request the key areas to name the relevant actors to be considered in the strategy for coordinating the partnerships, agreements and resources. It should be noted that this should be part of the roadmap for implementing the climate change adaptation plan and it should be validated with the business leadership.

2.1.3 IMPLEMENTATION

After preparing the adaptation plan, the next step involves its implementation. This phase also involves the follow-up and monitoring of the measures carried out, analyzing whether they are reaching the expected objectives and then making the necessary adjustments. Furthermore, it is important to have a **communication strategy**, identifying which indicators, processes and results should be communicated, to whom, when and how.

Actions and monitoring

- **Concept:** refers to the actions contained in the adaptation plan, which must be implemented and monitored to verify their completion and objectives achieved.
- **Objective and scope:** implement the actions provided in the plan, enabling and ensuring the appropriateness of personnel, financing and management. To ensure proper implementation and results, it is essential to monitor how the plan is being executed, defining, in advance, quantifiable indicators that can be easily observed and measured. Monitoring should also be continuous, making it necessary to determine how often each action is monitored.
- **Parties responsible:** teams of technicians and managers responsible for implementing the adaptation actions provided for in the plan preparation phase.

Evaluation and adjustments

- **Concept:** checking whether the planned actions have been completed and whether they adhere to the plan through previously defined indicators and analysis of the results, mainly by measuring whether goals were effectively achieved, in order to make any adjustments to the actions themselves or review of these goals or deadlines.
- **Objective and scope:** check the overall progress of the implementation of the adaptation plan, by comparing the performance indicators with the expectations, making adjustments and updates, where applicable. Adjustments include reviewing actions and, possibly, goals, if the reality of the implementation indicates that such goals can be improved. Updates typically involve the emergence of new weather scenarios.
- **Parties responsible:** teams of technicians and managers responsible for implementing adaptation actions supported by the team that prepared and coordinated the climate change adaptation plan.

Communication

- **Concept:** providing information about the climate change adaptation plan and its results to the internal audience, promoting verticalization and engagement with the climate issue within the company and increasing employees awareness, as well as the awareness of the senior management and external partners, local community, government and other relevant stakeholders. This may also improve the company's reputation and results and falls in line with the measures for engagement between industrial sectors in the same production chain.
- **Objective and scope:** inform the stakeholders about the need for the adaptation plan, its objectives and planned actions, what agents will take part in it and how climate adaptation will spread the actions and practices of each company to the production chain. Also provide information about its interfaces with society and the government, in addition to promoting the engagement of all mapped participants.
- **Parties responsible:** communication, social responsibility and institutional relations departments of the industrial companies as an integral part of their general communication and information system, supported by the team that coordinated and prepared the climate change adaptation plan.

Importance of incorporating the adaptation plan into the companies' management system

Climate change is a new topic for many industries and companies, and it's considered complex due to the diversity and uncertainty of projected changes in temperature, rainfall patterns, extreme events and other effects. Delaying adaptation actions may significantly increase the damage and losses to the industries. Risk anticipation and prevention, particularly by increasing awareness of threats and potential impacts, seems to be the smartest strategy to tackle this issue.

Worldwide, few industries have developed climate risk analysis and incorporated them into their management tools. The key to successful adaptation is determining the magnitude of the risk and identifying available actions that must be taken to respond to it. Many organizations have risk management practices in place, which can range from risk management systems fully integrated into the company to minor applications.

Whether the intention is to spread risk management practices across the organization or merely implement it in order to prevent the impacts of climate change, companies should seek adequate technical support, as this can prevent and reduce loss of life, production and industrial competitiveness.

To assist industries in preparing the adaptation plan, the next chapter will present the steps of the UKCIP methodology, adapted to Brazil by FGVces. These were broken down in a PDCA process flow based on management systems in the standard ISO 9001:2015 - Quality Management System - Requirements and ISO 31000:2018 - Risk Management - Guidelines for the industry's reality.

Through a more visual approach, industries will then understand the steps required to become more resilient to the challenges of climate change impacts.



3 BUILDING THE PLAN OF ADAPTATION TO CLIMATE CHANGE IN THE INDUSTRIAL SECTOR



The PDCA cycle, which stands for PLAN-DO-CHECK-ACT, presents a continuous sequence of steps, which are important to carry out the processes. The method is a management tool used to ensure the continuous improvement of processes and to solve problems (UENO, 2016). In view of this and as companies and organizations recognize the tool as a method of quality management, the PDCA cycle was selected as a way to present the required information to prepare an adaptation plan, helping companies to find adaptive solutions for the climate challenges.

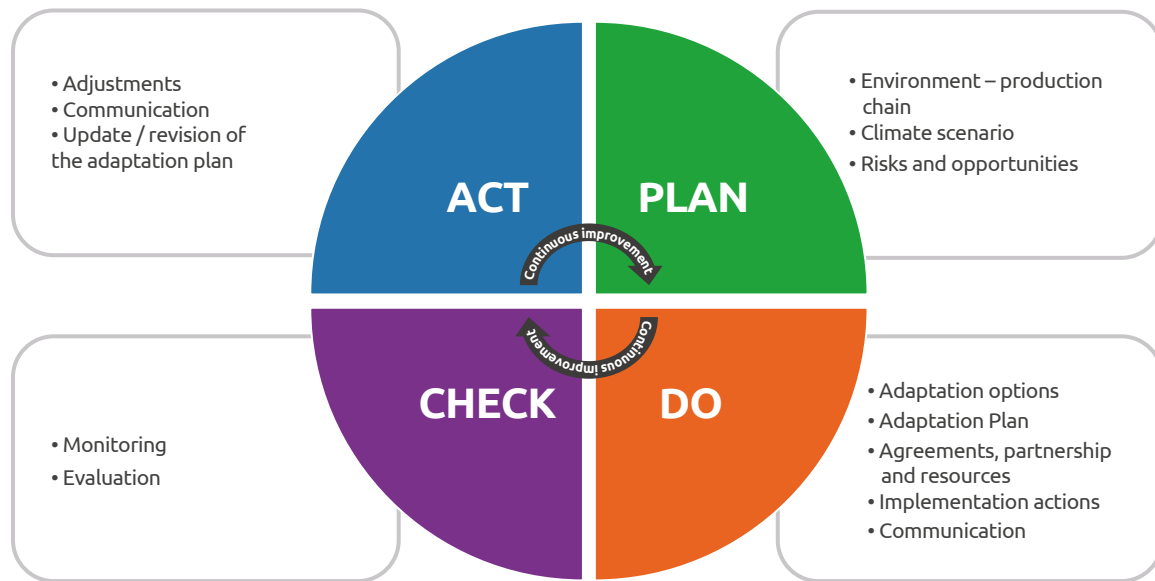
The PDCA cycle can be used by the quality management system as an essential factor in increasing the competitiveness of the industry, reducing costs, increasing productivity and reacting to changes in the market (UENO, 2016). In this sense, by using it as a flow to prepare the adaptation plan, we can internalize the risks and opportunities of the climate change agenda in the companies' production chain management system.

It should be noted that, when preparing a plan of adaptation to climate change, where the uncertainties and the high speed of global learning on the subject and its impacts are significant, the adaptation plans may need to be updated. This means that the flow must be cyclical in nature, updating the proposed adaptive measures based on how climate scenarios manifest and as uncertainties surrounding forecasts become less likely to appear.

3.1. PREPARING THE PDCA FLOW

The UKCIP methodology was adjusted in order for its steps to fit into the PDCA cycle. Figure 5 below succinctly shows the relationship between the steps in the two systems.

FIGURE 5 – List of phases involved in the preparation and implementation of a climate change adaptation plan in industry (PDCA cycle) with the UKCIP methodology adapted by FGVces



Source: Prepared in-house from UENO (2016) and GVCes (2015).

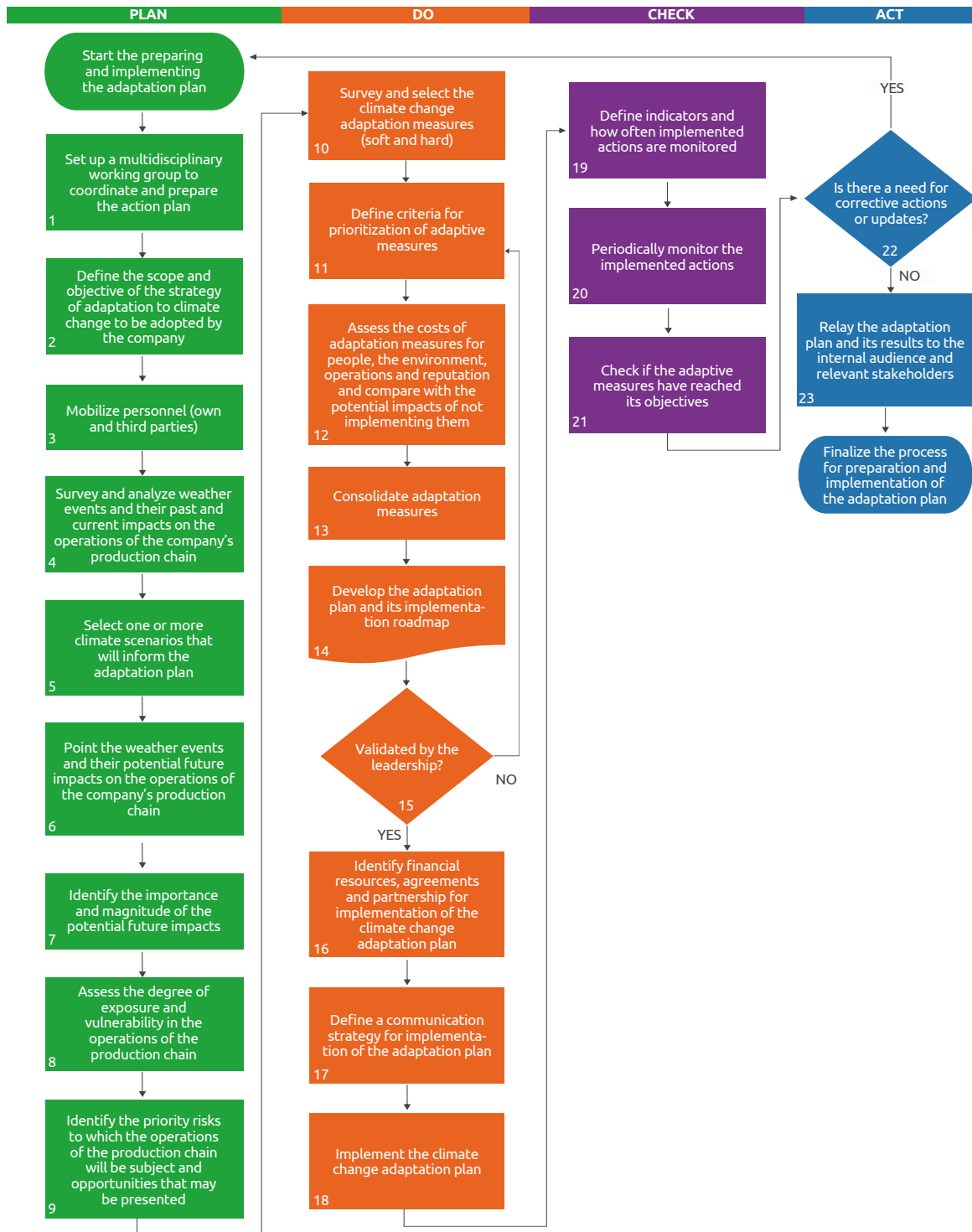
Process flow

The flowchart below is a suggestion for industrial companies to prepare and implement their climate change adaptation plans, detailing the main stages present in the proposed PDCA cycle (figure 5). A band runs along the bottom of the entire flow, indicating the "Continuous Improvement". This means that the flow must be continuously updated by making the necessary changes to ensure its effectiveness.

The process flow is accompanied by the auxiliary table 3 below, which details the activities at each stage (figure 6). Notice that there is a number in each box of the flowchart, which identifies the step in the table in question. There, we can find further information about the objectives and the teams suggested to be responsible for the relevant actions in the organization.

To obtain the forms to prepare and implement the climate change adaptation plan, please visit the AdaptaClima platform (<http://adaptaclima.mma.gov.br/>), more specifically at the website (http://eaesp.fgv.br/sites/eaesp.fgv.br/files/u641/ferramenta_epc_2-0.xlsx).

FIGURE 6 – Steps involved in the preparation and implementation of the climate change adaptation plan via the PDCA cycle



Source: Prepared in-house from UENO (2016) and GVCes (2015).

TABLE 3 – Auxiliary table of the steps involved in the preparation and implementation of the plan for adaptation to climate change via the PDCA cycle in the industry

PDCA	ID	STEP	OBJECTIVES	SUGGESTIONS FROM THE AREAS IN CHARGE
P	1-3	Environment – production chain	<ul style="list-style-type: none"> • Create a multidisciplinary group to work on the preparation and coordination of the climate change adaptation plan, involving different sectors of the company. • Define scope, objective, barriers and motivations for the development of the company's climate change adaptation strategy. • Mobilize employees (own and contractors), according to the scope of the adaptation plan. 	<ul style="list-style-type: none"> • Team dedicated to the coordination and preparation of the climate change adaptation plan with the support of senior management.
	4-6	Climate scenario	<ul style="list-style-type: none"> • Survey and analyze weather events and their past, current and potential future impacts on the company's production chain operations. • Define climate scenarios and forecasts that apply to the company's situation and understand the expected changes in the patterns of the most important climate variables for the business. To choose the best climate projections, check the contents of box 4 of this guide. 	<ul style="list-style-type: none"> • Area dedicated to the coordination and preparation of the climate change adaptation plan with external support for the development of a specific technical study that outlines a range of likely climate scenarios. <p>Note: Companies should involve areas that know and deal with past, present and potential future climate impacts and that can contribute towards identifying studies and scenarios and interpreting information suitable for the company's situation.</p>
	7-9	Risks and opportunities	<ul style="list-style-type: none"> • Define the magnitude of potential future impacts. • Assess the degree of exposure and vulnerability of the company's production chain. • Identify and prioritize the risks to which industrial operations and their production chain will be subject and the opportunities that can be presented from the diagnosis of possible climate scenarios. 	<ul style="list-style-type: none"> • Area dedicated to the coordination and preparation of the climate change adaptation plan while consulting other sectors of the industrial production chain subject to the mapped risks and opportunities.
D	10-13	Adaptation options	<ul style="list-style-type: none"> • Identify and select effective adaptation measures to minimize different risks and threats, ensuring that they are feasible to implement. • Define which prioritization criteria should be adopted - such as effectiveness of measures, costs and benefits, financial capacity, company and/or social acceptability, indirect gains, etc. • Assess whether the implementation of adaptation measures will make the industry's supply chain more resilient to the impacts of climate change, based on the calculation of the residual risk. 	<ul style="list-style-type: none"> • Areas and sectors of the industrial production chain identified under the mapped risks must be involved to identify appropriate adaptation measures (according to climate scenarios, risks and potential opportunities). All evaluated and approved adaptation measures must be reported to the team responsible for coordinating and preparing the adaptation plan. <p>Note: It might be a good idea consult some of the external partners present in the location(s) covered by the adopted scope.</p>
	14-18	Adaptation plan and implementation actions	<ul style="list-style-type: none"> • Define and approve, with the senior leadership, the climate change adaptation plan and its implementation roadmap - what to do, who is responsible for what, deadlines, goals, investments, source of financial resources and how and where the operation will be carried out. • Identify agreements and partnerships that can make the implementation of the adaptation plan feasible. • Establish a communication strategy. • Implement the climate change adaptation plan. 	<ul style="list-style-type: none"> • Team responsible for coordinating and preparing the climate change adaptation plan, senior leadership, institutional relations and communication department. It is essential to involve the company's internal areas responsible for implementing the adaptation measures. Note: Ideally, the company should request the key areas to name the relevant actors to be considered in the strategy for coordinating the partnerships, agreements and resources.

PDCA	ID	STEP	OBJECTIVES	SUGGESTIONS FROM THE AREAS IN CHARGE
C	19-21	Monitoring and evaluation	<ul style="list-style-type: none"> • Define how often the implemented actions and performance indicators will be monitored. • Check the overall progress of the implementation of the climate change adaptation plan through the performance indicators. • Identify and record whether the objectives of the adaptation measures designed in the plan were achieved, as well as their lessons learned and necessary adjustments. 	<ul style="list-style-type: none"> • Teams of technicians and managers responsible for implementing the adaptation actions with the support of the team that coordinated and prepared the adaptation plan.
A	22	Adjustments and update	<ul style="list-style-type: none"> • Determine whether any revisions and/or updates of the climate change adaptation plan are needed in each time cycle, to be determined by the company, based on identified improvements/adjustments and new climate scenarios. 	<ul style="list-style-type: none"> • Teams of technicians and managers responsible for implementing the adaptation actions, supported by the team that coordinated and prepared the plan and the senior leadership.
	23	Communication	<ul style="list-style-type: none"> • Establish a communication strategy to inform the various stakeholders about the need for the climate change adaptation plan, objectives, planned actions, results to be achieved, etc. • Emphasize how climate adaptation will spread the actions and practices of each industrial company in the production chain. 	<ul style="list-style-type: none"> • Departments of communication, institutional relations, social responsibility and the environment of the industrial companies with the support of the team that coordinated and prepared the adaptation plan.

Source: Prepared in-house from UENO (2016) and GVCes (2015).



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