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© ADIZIA - Photo of the Ait Melloul industrial estate

Methodological Guide for the Adaptation to Climate Change of Industrial Zones

A guide on climate risk and opportunity management for the use of those involved in managing existing industrial zones

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Preamble

Dear reader,

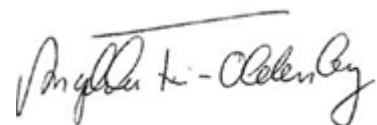
We are currently living in a world where climate change is a scientifically and almost unanimously accepted reality. Even if greenhouse gas emissions are reduced to zero, the earth will continue to warm up before it returns to an equilibrium. It is in this context that adaptation to the effects of climate change is becoming a priority challenge for all actors in order to ensure the sustainable development of their countries. Indeed, climate change affects many countries - who are partners of German Development Cooperation - very strongly due to their geographical location and climatic conditions. Until now, small and medium-sized enterprises in particular have not had sufficient capacity and infrastructure to adapt to these challenges. In many cases, there are no funding opportunities to adapt them, or these opportunities are unknown to the actors concerned.

We are firmly convinced that the management of climate risks and opportunities is an issue that has its place in promoting the sustainability and competitiveness of small and medium-sized enterprises. Industrial zones represent a space where the resilience of the companies depends on the resilience of the area in which they have established themselves. This gives industrial zone managers a priority role in raising awareness, and supporting small and medium-sized enterprises in their efforts to adapt to climate change.

Recognising these needs, the GIZ has developed an innovative and modular approach called "*Climate Expert*" to support the private sector in these adaptation efforts. This approach has been adapted for industrial zones in Morocco based on a pilot project conducted within the Ait Melloul industrial zone in the Souss Massa region. The proposed methodology supports industrial zone managers in confronting and managing climate change issues and providing complementary services to small and medium-sized enterprises.

We cannot conclude these introductory remarks without thanking our partners in Morocco: the Association of Investors of the industrial zone Ait Melloul (ADIZIA), the Souss Massa Regional Centre for Investment, the Souss Massa Regional Council, the Souss Massa Chamber of Commerce, Industry and Services, the Regional Observatory for the Environment and Sustainable Development (OREDD) in Souss Massa and the Collective of industrial zones for the Environment (COZINE) We also strongly thank Michael Gajo, Head of GIZ Environment and Climate Portfolio in Morocco and his team who supported the project from the beginning and manifold contributed. Without these partners the project could not have enjoyed such success.

We sincerely hope that this guide will be useful as an operational tool for all actors in charge of the development and management of industrial zones.



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First, we would like to express our deepest thanks to PSACC’s partners whose contributions fed into the French version of this guide:

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Coopérative COPAG

Examiners

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Abbreviations

ABH:	Agence de Bassin Hydraulique
ACC:	Adaptation to Climate Change
ADEREE:	Agence Nationale pour le Développement des Énergies Renouvelables et de l'Efficacité Énergétique (renommée Agence Marocaine de l'Efficacité Énergétique)
CBA:	Cost-benefit analysis
CC:	Climate Change
CCISA:	Chambre de Commerce, d'Industrie et de Services Agadir
CEA:	Cost-Effectiveness Analysis
CFCIM:	Chambre Française du Commerce et de l'Industrie du Maroc
COZINE:	Collectif des Zones Industrielles pour l'Environnement
CRI SM:	Centre Regional d'Investissement Souss Massa
EBRD:	European Bank for Reconstruction and Development
ECG:	Environmental and Climate Governance
FEC:	Fonds d'Équipement Communal
FODEP:	Fonds de Dépollution Industrielle (<i>Industrial Pollution Control Fund</i>)
FONZID:	Fonds des Zones Industrielles Durables (<i>Sustainable Industrial Zones Fund</i>)
GHG:	Greenhouse gases
GIZ:	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
IPCC:	Intergovernmental Panel on Climate Change
INDH:	Initiative Nationale pour le Développement Humain
IZ:	Industrial Zone
IZAM:	Industrial Zone in Ait Melloul
LDCs:	Least Developed Countries
ONEE:	Office Nationale de l'Électricité et de l'Eau Potable (<i>National Office of Electricity and Drinking Water</i>)
OREDD:	Observatoire Régional de l'Environnement et du Développement Durable (<i>Regional Observatory for the Environment and Sustainable Development</i>)
PGPE:	Programme de Gestion et de Protection de l'Environnement (<i>Environmental Management and Protection Program</i>)
PNACC:	Plans Nationaux d'Adaptation au Changement Climatique
PSACC:	GIZ programme "Private Sector Adaptation to Climate Change"
RAMSA:	Régie Autonome Multiservices d'Agadir
SMEs:	Small and Medium Enterprises
UNFCCC:	United Nations Framework Convention on Climate Change

Introduction to this guide

Objective and target group

This guide is a support instrument for the main actors involved in the management of an industrial zone, in particular industrial zone managers, public and local authorities, industrial associations, public and private developers, planners and civil society. The guide aims primarily at actors in established industrial zones, who play a key role in raising awareness and supporting SMEs in managing climate risks and opportunities.

The main objective of the guide is to support a better integration of climate risk into the management of industrial areas. It has the following objectives:

- Provide an introduction to Adaptation to Climate Change (ACC) in the context of IZs
- Provide an approach and assessment tools on climate risk and opportunity management for IZs
- Provide recommendations on the main steps to initiate an ACC process for an existing IZ

Methodology of this guide

This guide is based on the pilot experience in the Souss Massa region of Morocco as well as the international expertise of the GIZ in the field of ACC and Sustainable Industrial Zones. The approach proposed in the guide was developed using a participatory approach, with the contribution of the partners in the pilot phase (CRI SM; ADIZIA; Regional Council Souss Massa; OREDD; CCISA), and the members of COZINE¹. In addition, the approach was based on the work of the *Sustainable Industrial Areas* (GIZ, SIA) working group, the *Programme for Environmental Management and Protection in Morocco* (GIZ Morocco, PGPE 2002-2015), as well as on the experience of the project *Adaptation to Climate Change and Valorisation of Biodiversity - Implementation of the Nagoya Protocol* (GIZ Morocco, ACCN 2013-2016).

The guide introduces ACC in the context of industrial zones, as well as an approach and tools to help managers integrate climate risk into their management. The methodology is illustrated by examples of good practices in Morocco and internationally, and general recommendations.

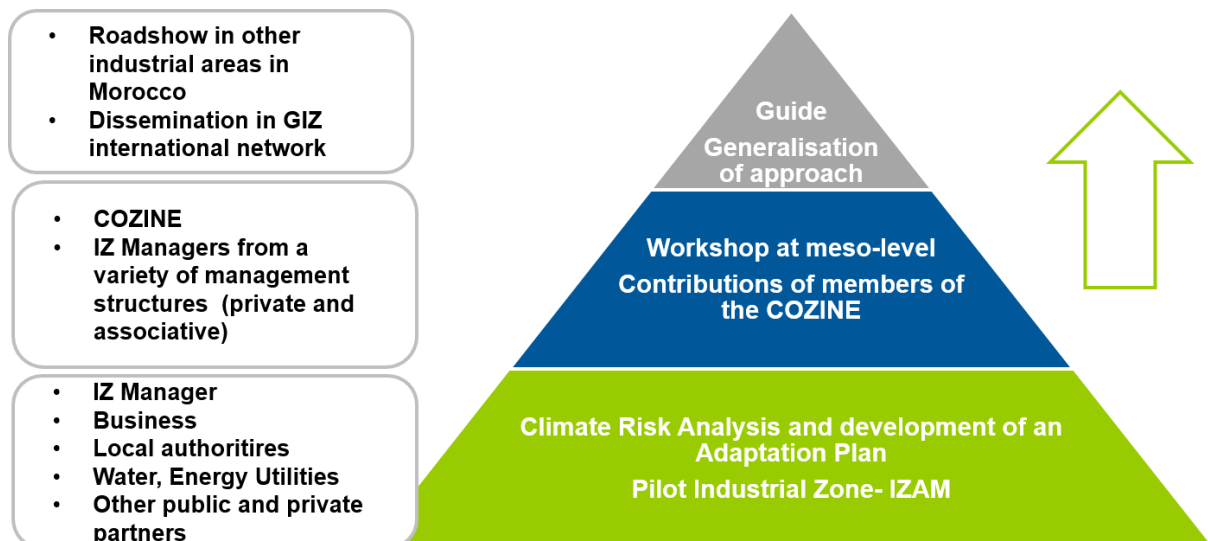


Figure 1: Context and approach to the development of the guide

¹ COZINE is a platform for exchanges for associations and companies managing Moroccan Industrial Zones on the theme of sustainability.

Overview of the guide



Section A: Industrial zones and adaptation to climate change

This first part presents the **challenges and fundamentals of climate change adaptation in the context of industrial zones**. It answers the following questions:

- Why do industrial zones have to adapt? What are the issues at stake?
- What are the climate trends and projections in Morocco?
- What are the risks and opportunities of climate change for an IZ?
- What measures should be put in place to strengthen the resilience of industrial zones?



Section B: Implementing an adaptation strategy

In this section, we propose **tools and a systematic approach** to support managers in the **development of an adaptation strategy**. It answers the following questions:

- How to start a process of adapting to climate change for an IZ? What are the main steps and how can this process be operationalised?
- Which actors should be involved and how to win their commitment?
- What are the prerequisites for implementing an adaptation strategy?



Section C: Strengthening the adaptive capacity of Industrial zones: Recommendations

This last part is dedicated to the **support factors and actions needed to support the IZ and managers in their adaptation efforts**. It presents recommendations and answers the following questions:

- How to strengthen the adaptive capacity of IZs?
- What technical, financial and political support is needed to help IZs in their adaptation process?



Supporting tools and references

- List of publications, resources and tools for further development
- Fact sheets by impact area to support risk analysis
- Additional case studies

Key Messages



- Climate change has become a reality. The private sector is directly affected by climate change and needs to address it.
- It represents a challenge for all economies. The industrial zones which concentrate a large majority of SMEs are particularly vulnerable areas.



- Climate change has direct and indirect effects on businesses and industrial zones. It represents a challenge for their sustainability and competitiveness.
- A variety of areas of an industrial zone are affected by the effects of climate change - not just infrastructure and the industries.



- Even though the impacts of climate change are difficult to predict, they can be managed like any other risk.
- Anticipating and adopting a climate risk management strategy will help to avoid significant costs.



- Industrial zones can be vulnerable areas but at the same time they offer synergies and opportunities to make businesses more resilient.
- Adaptation to Climate Change contributes to increasing the attractiveness and competitiveness of areas and enterprises.



- Companies adapting to climate change will benefit from a wide range of new opportunities. However, they also need the assistance of the public sector in this process.
- Collaborations and partnerships between companies and public actors are essential to strengthen the resilience of industrial zones and their companies.

Photo: GIZ; adelphi, Prefecture Izegane Ait Melloul

Key concepts

The notion of "Industrial Zone" in the context of the guide



Photo: ADIZIA - Photo of the Ait Melloul industrial Zone

Types of industrial zones

A wide range of terms is used to describe areas of industrial and commercial activities, such as:

- Industrial zones
- Free zones
- Commercial zones
- Sustainable Industrial Areas (SIAs)
- Industrial parks
- Eco industrial parks
- Eco zones or low carbon zones
- Offshore production centres
- Competitiveness clusters

These are designated areas within a well-defined locality, dedicated to hosting industrial and/or commercial activities, by providing necessary infrastructure and a number of services to companies. However, the different types of zones differ in their specializations, their infrastructures, and their particular regulatory status.

Types of management structures

The challenges of managing industrial zones have led to the creation of different structures (associations, management companies, etc.) that carry out management and development tasks in these areas. The means, knowledge and capacities of these structures differ according to the history and management mode of each IZ. In Morocco, there are three main management structures: 1) Industrial Associations, 2) Trustees (*syndics*) and 3) Management Companies (*société de gestion*) managing the assets of different shareholders from the public and private sectors. These structures all cooperate closely with municipalities, local authorities and decentralised state services, as well as with the providers of the main basic services (water, electricity, etc.).

Evolution process

In the context of Adaptation to Climate Change in industrial areas, it is important to distinguish between existing industrial areas and the planning of new areas. Indeed, an industrial zone evolves over time by passing through 4 phases during which the notion of adaptation to climate change has to be taken into account:



- **Planning** describes the design and programming of a defined industrial area. It is generally the result of political decisions taken at national, regional or municipal level.
- **Development** describes the construction of an industrial zone, usually carried out by private sector actors after calls for proposals.
- The **management** describes the maintenance (e.g. of infrastructure), the services offered to companies and visitors, and bringing together the various actors in the area with external actors.

- **Retrofitting** is the rehabilitation, redefinition or adaptation of an industrial zone with respect to the issues that affect it. These changes can be physical as well as apply to the management.²

This guide will only use the terms "industrial zones (IZs)" and "management structures". Nevertheless, the proposed methodology is applicable to different types of industrial areas, irrespective of degree of organisation.

In addition, the priority target groups are existing Industrial Zones, which is why the proposed approaches and instruments focus on the "management" and "retrofitting" phases of the life of an Industrial Zone. However, the proposed approach is also applicable to the planning and development of new industrial areas.

Climate Change: What is it?



Photo: GLZ

Climate change refers to significant and persistent weather/climate changes over long periods (decades or more). These changes can be **gradual over the long term** such as temperature rises or decreasing precipitation; or a **more frequent observation of extreme climatic events** such as storms, heat waves or floods. Climate change is attributed directly and indirectly to human activity and its production of greenhouse gases (GHGs), which degrade the atmosphere and cause a general increase in average temperatures. This is in addition

to natural variations in climate observed over comparable periods. The more GHGs are produced and released in the atmosphere, the more severe climate change will be and the more inevitable its impacts.

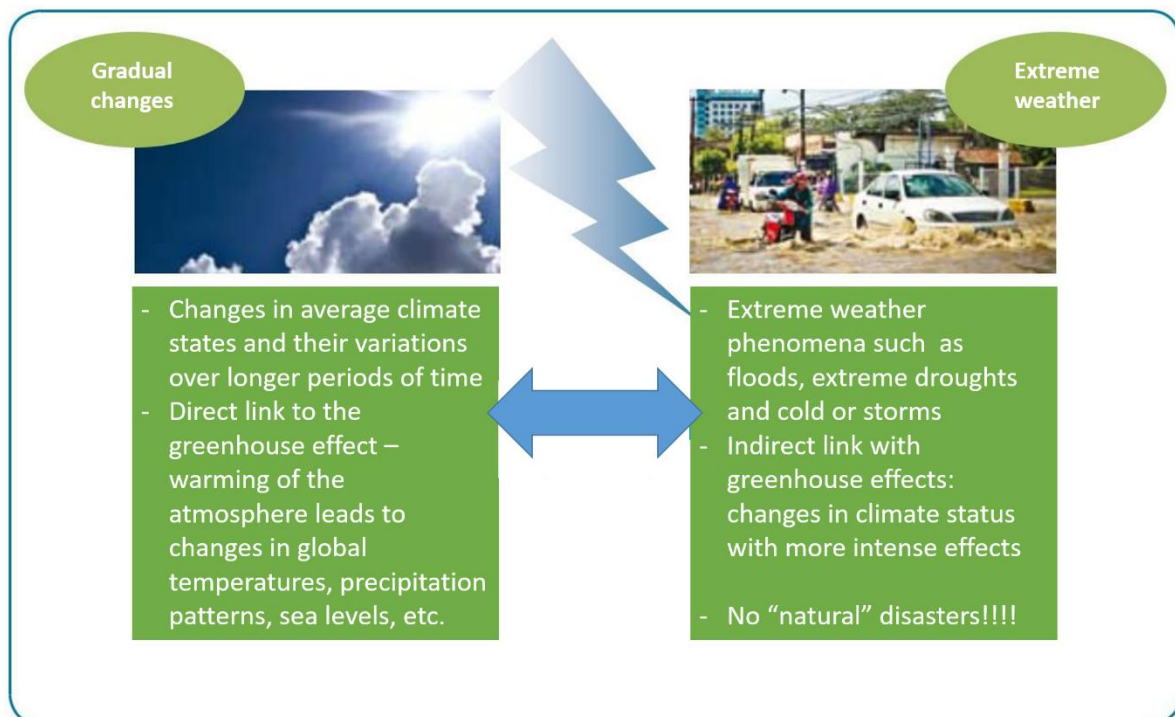


Figure 2: The two major effects of climate change
(Source: Climate Expert Training, adelphi)

² Orientation guide for the transition to Sustainable Industrial Zones in Morocco (https://drive.google.com/file/d/0B3_0MxSwg-e5SHRYWY4WmRYkE/view)

The general definition of Adaptation to Climate Change



Photo: GIZ

Adaptation to Climate Change means "the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects" (IPCC)³. The definition of adaptation applies to long-term incremental climate change, as well as climate variability or extreme weather events.

The concept of Adaptation to Climate Change is not new. People, businesses and governments have always sought ways to cope and develop in times of drought, flood or other climatic extremes. However, it is now widely accepted that even if we succeed in reducing GHG emissions in the future, GHG emissions already released into the atmosphere will continue to contribute to rising temperatures, resulting in climate change in the short and long term. A relatively small increase in average temperatures is likely to lead to an increase in the frequency and intensity of natural disasters and extreme weather events such as floods, droughts and heavy rainfall. The particular difficulty of adaptation is that there is a high degree of uncertainty about the regional and local consequences of this change, even over a 20-year horizon used by companies.

In the context of existing industrial zones, ACC is synonymous with "**climate risk (and opportunity) management**". As well as financial and operational risks, climate risk can have consequences in terms of competitiveness, performance and reputation, but also on the environment and safety. In the context of new industrial zone creations, ACC means integrating climate risk into the planning and development of the new industrial zone. Climate risks (such as the risk of flooding) must be taken into account as criteria for the development of new industrial areas and in investment decisions. In other words, adaptation means "**implementing actions and measures to minimise climate-related risks**".

What is an adaptation measure?

Adaptation measures attempt to reduce the vulnerability of a system or organisation to climate risks. They can be carried out at different levels and are the result of a process of risk analysis and identification of actions that can be taken to reduce or eliminate these risks.

Table 1: Definition of adaptation - examples

	Examples of Adaptation to Climate Change
Company level	<ul style="list-style-type: none"> ▪ Install and design installations that are highly resistant to extreme weather conditions ▪ Develop water-efficient products and processes in areas affected by water shortages ▪ Diversify suppliers and consider alternative markets
Industrial zone	<ul style="list-style-type: none"> ▪ Reduce vulnerability by relocating to lower risk areas (planning/development phase, creation of new IZs) ▪ Construct common flood protection works in areas at risk of flooding (management/requalification phase, existing IZs)

³ Glossary of the Intergovernmental Panel on Climate Change (IPCC): https://www.ipcc.ch/site/assets/uploads/2019/01/SYRAR5-Glossary_en.pdf

	<ul style="list-style-type: none"> Integrate green spaces into high-concrete industrial areas to improve the surrounding temperature while at the same time improving working conditions and facilitate water infiltration during periods of heavy rainfall
<p>City / municipality / region</p>	<ul style="list-style-type: none"> Increase the volume of groundwater storage in anticipation of drought periods and increase the capacity of the infrastructure Install early warning systems for extreme weather events Establish new building codes to ensure better insulate buildings in areas prone to high temperatures

Adaptation vs. Mitigation of Climate Change

It is important to differentiate between climate change adaptation and climate change mitigation in the context of industrial areas: **adaptation** means preventing, coping with and managing the inevitable effects of climate change on infrastructure and business. **Mitigation** means reducing or limiting greenhouse gas emissions from industrial activities.

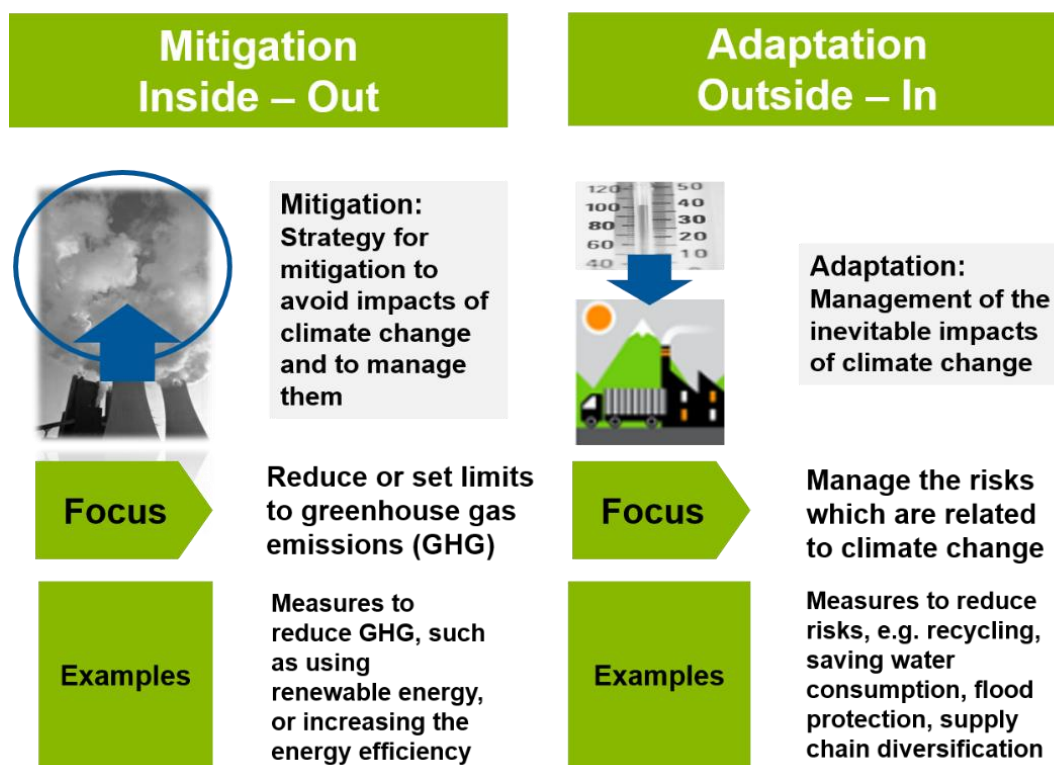
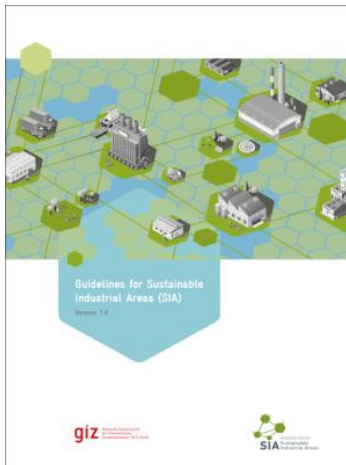


Figure 3: Understanding the difference between adaptation and mitigation

(Source: Climate Expert Training, adelphi)

Climate Change Adaptation and Sustainable Industrial Zones



The concept of "Sustainable Industrial Areas" (SIAs)⁴ addresses the issue of sustainability by integrating economic, ecological and social aspects into industrial areas. This requires, in particular, management structures focused on resources and energy efficiency, environmental protection and social cohesion. While some governments and institutions are mainly interested in Eco Industrial Parks (EIPs), GIZ considers the SIAs approach to be more comprehensive, integrating all three aspects of sustainability. GIZ has developed the SIA guidelines with the aim of supporting industrial areas in their sustainability approach. SIA project representatives and experts have formed the GIZ SIA working group, which, together with its partners around the world, is constantly working on the development of the concept of "Sustainable Industrial Areas".

The SIA guidelines for the development of sustainable industrial zones apply to the whole industrial zone or the management of an industrial park. The objective is to guide the industrial zone as a whole towards a sustainability strategy and less to support individual companies. The sustainability performance of companies within the area is supposed to be guided by a sectoral approach or through rules or standards within companies. However, a sustainable development framework at the park level is also likely to initiate and promote positive changes at the company level. The SIA guidelines are intended for industrial park managers and operators, industrial zone planners, public administrators in charge of regulating zones and industrial experts and advisers on industrial development. They highlight the most important sustainability aspects for the planning and operation of an industrial zone and the development of a legal framework for the development of a sustainable industrial zone.

The theme of Adaptation to Climate Change is included in the SIA guidelines, particularly at the levels of criteria 1.7 "Disaster Risk Management" and 3.7 "Mitigation and Adaptation to Climate Change". This guide contributes to the operationalisation of these criteria in the context of the management and retrofitting of industrial zones. The guide also shows how integrating climate risk into the management of an IZ can enhance the sustainability of an IZ as a whole, and operationalize other SIA criteria.

⁴ More information on the GIZ guidelines of SIA can be found under the following link: <https://www.sia-toolbox.net/solution/sia-guidelines>

Section A: Industrial Zones and Adaptation to Climate Change

This first part presents the challenges and fundamentals of climate change adaptation in the context of industrial zones.

- Why do industrial zones have to adapt? What are the issues at stake?
- What are the climate trends and projections in Morocco?
- What are the risks and opportunities of climate change for an IZ?

2014 floods in the Ait Melloul Industrial Zone



Photo: Préfecture Inezgane Ait Melloul



"For us Entrepreneurs, there are two factors that we cannot control, but confront and manage: the climate and the market"

Omar Mounir, Entrepreneur, Former President of the l'Association des Investisseurs de la Zone Industrielle d'Aït Melloul (ADIZIA) and Spokesman de la Fédération Interprofessionnelle des Fruits et Légumes à l'Export (FIFEL)
(Quote translated for this guide)

1. Background information

1.1 What are the challenges for industrial zones?

Over the past few decades, industrialization in Morocco has grown rapidly and has been an engine of economic growth. Despite a significant commitment to industrial infrastructure development over the past decade, industrial areas and their companies are now facing a series of market, supply chain, financing and insurance pressures. In addition, new regulations, the advanced age or failure of infrastructure and environmental problems are factors that also influence the performance of industrial zones. The impacts of climate change such as storms and floods, heat waves or droughts are likely to exacerbate these pressures.

The impacts of climate change on industries and industrial areas can be direct or indirect. They can affect buildings, infrastructure, corporate production and inventories, employees, the supply chain, market demand, finance or insurance. The potential impacts of climate change are generally determined according to exposure to climate factors based on the location and specific industry characteristics. It is often these non-climatic aspects that strongly determine the vulnerability of a system - for example, deficient and poorly managed drainage and sanitation systems that are already ineffective during heavy rains - that will certainly not be able to cope with the increased frequency and intensity of floods.

While entrepreneurs are increasingly aware of the concepts of eco-parks and sustainability, industrial zone managers are often not aware that climate change can affect the competitiveness of companies and intensify environmental risks. These may include, for example, increasingly frequent droughts putting additional pressure on already overused groundwater resources, or an increased frequency and magnitude of heavy rains that increase the risk of flooding in IZs with poorly sized or poorly maintained drainage systems. Indeed, in the various debates on industrial zones, the term "adaptation" or "climate risk" is rarely mentioned. The discussions generally revolve around resource efficiency (concerning raw materials and energy), safety and health, profitability, business services, production costs, pollution or wastewater. However, there is a growing awareness: adaptation is an integral part of the reference frameworks for the development of Sustainable Industrial Areas (SIAs) such as the criteria of the GIZ or the High Environmental Quality standard used by the Franco-Moroccan Chamber of Commerce and Industry in Morocco. Initial experiences on the integration of ACC into the planning and retrofitting of industrial zones are visible at the international level⁵ and in Morocco⁶.

In Morocco, the industry accounts for 14% of GDP and the objective is to reach 23% by 2020. Industrial zones constitute the major part of industrial production while hosting a large majority of SMEs, which are the economic pillar of the national economy and thus play a major role in creating value and jobs at the national level. They also reflect a representative image of regional and local development and can be a gateway for foreign investors. Thus, in view of the current and expected pressures of climate change, it is essential that industrial areas gradually strengthen their resilience to climate risks to ensure their survival and competitiveness. The integration of adaptation plans is one of the key pillars of new local development policies and the private sector must be actively involved in this process.

Box 1: Flood costs for industrial zones: Moroccan experiences

Berrechid 2001: Floods at the end of 2001 caused damage estimated at more than 200 million dirhams (> 2 million USD) to businesses in the IZ. Hundreds of workers were out of work for several weeks. 60% of the affected units had to stop their activities for more than a fortnight, stocks of products were lost, production equipment threatened, and export contracts were terminated because the affected companies were unable to meet delivery deadlines. In addition, in view of the recurrence of the phenomenon in this area, insurers refused to cover the damage suffered and businesses threatened to leave the area.

Tangier 2008: In October 2008, the city of Tangier and its industrial zone were victims of torrential rains causing disastrous floods, paralysing the economy for several days and affecting, in the long term, the industry in the region. Many underground electrical distribution stations were out of service and caused numerous power outages. The IZ of Tangier (Moghogha) suffered a 3-day power outage. In the end, the Tangier industrial estate had suffered more than 1.5 billion MAD (> 0.15 billion USD) in damage to machinery, installations, repairs, loss of raw materials, stocks and semi-finished products and thousands of people have been left unemployed.

Casablanca 2010: The industrial areas of Sidi Bernoussi, located north of Casablanca on the road to Rabat, were affected by heavy rainfall in December 2010. The effects of this climatic event were amplified by the flood that blocked the water drainage and the geographical location of the industrial area that favoured flooding. The industrial areas of Sidi Bernoussi formed a "tank" where water poured in from the residential district of Sidi Bernoussi and the sewage network was not able to absorb all the rainfall. Older areas not adapted to industrial needs were highly vulnerable to the effects of climate change. Roads providing access to the areas were also closed, production was interrupted for at least 5 days for businesses, and often longer for the textile industries, causing losses of profits and customers. The damage caused by the floods one year after the floods amount to nearly 40 million dirhams (~ 4.1 million USD) and 85 companies, or nearly 15% of the IZ's units, were affected.

Sources: AZIT, IZDIHAR, *leconomiste.com*; *maghress.com*

⁵ See international case studies presented in section 4.3 and in appendices

⁶ See box on the Berrechid Industrial Zone in section 1.3

1.2 Why adapt?

The private sector must adapt to the changing climate to remain competitive and survive in the medium and long term. As a major actor in local economic development, industrial zones can play a central role in this process. On the one hand, by guaranteeing the proper functioning of their services and infrastructures, they ensure **the survival and continuity of their spaces and the businesses** in the face of climate risks. On the other hand, by concentrating companies, they become a **key multiplier to raise awareness and support companies in their adaptation efforts**.

Beyond the direct benefits of strategic climate risk management, **adaptation also offers many opportunities** for industrial areas, such as access to new financing for certain infrastructure projects, or a better image and range of services for local investors and stakeholders. By promoting adaptation, managers also contribute to **strengthening innovation and business competitiveness**. As market or production conditions change because of climate change, new business opportunities are opening up for companies. We provide an overview of adaptation opportunities in the context of industrial zones in the figure below.

Adapting means ensuring the continuity and survival of an industrial zone, while promoting the sustainable growth of companies

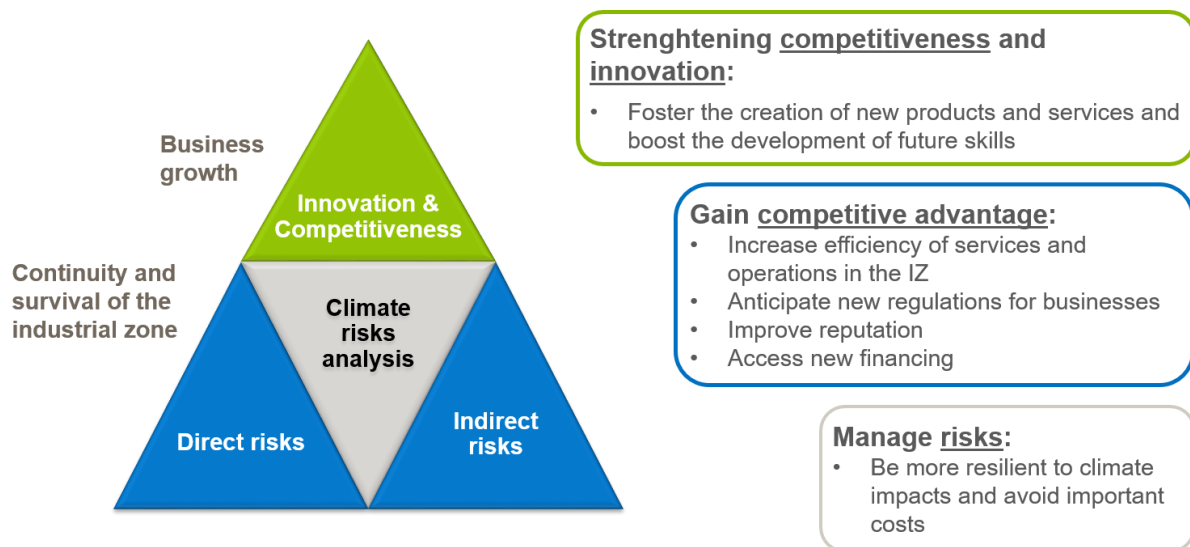



Figure 4: Benefits of Climate Change Adaptation for an Industrial Zone

Source: Climate Expert training, adapted for Industrial Zones; adelphi

Table 2: Benefits of Adaptation to Climate Change

For industrial areas, adaptation is part of a strategy of sustainable economic development:	For companies, adapting is part of an economic logic:
<ul style="list-style-type: none"> ▪ Strengthening the competitiveness of industrial areas by integrating a sustainable development approach ▪ Reinforcing the attractiveness and image of the region ▪ Strengthening the resilience of companies to the impacts of CC ▪ Generate new market opportunities and promote innovation at the local level ▪ Promote the development of future skills at the local level 	<ul style="list-style-type: none"> ▪ Avoid considerable costs and losses that could result from extreme events ▪ Increase the efficiency of operations and optimize production costs in the face of increasing pressure on natural resources (energy, water) ▪ Source of innovation and new market opportunities (new products and services) ▪ Anticipate stricter regulations that would generate large investments ▪ Investing in future skills ▪ Improve the company's reputation
 <p>Ensure business growth, competitiveness and job security</p>	

Making an industrial zone resilient means strengthening both the adaptation capacity of infrastructure and communal services and the adaptation capacity of companies. Both parts must be addressed together with regards to climate risks and opportunities.

By combining better risk management and new economic opportunities, areas resilient to climate change become creators of wealth and drivers of sustainable development.

1.3 Adaptation and the life cycle of an IZ

The integration of climate change adaptation into the life of an industrial zone evolves around the stages of development of an industrial zone⁷. The distinction between planning, development, management and retrofitting is important because the actors involved, the measures and the decision-making processes differ from one stage to another. **This guide mainly targets established industrial zones, and therefore the management and retrofitting phases** of an industrial zone. Before going into more detail on the integration of adaptation into industrial zone management, it is important to consider the particularities of adaptation dependent on the stage of development.

⁷ The 4 stages of evolution of an Industrial Zone are defined in the "Orientation Guide Towards the Sustainable Transition of Industrial Zones in Morocco" (MEMEE/MDE and GIZ). All the stakeholders involved in industrial zone development in Morocco recognize this ranking.

Table 3: Adaptation to Climate Change in the life cycle of an industrial zone

Steps in the life of an IZ	Taking adaptation into account	Key actors involved in the adaptation process
Planning	With regards to planning procedures, adaptation involves, for example, the integration of site selection criteria that take into account geographical and sectoral vulnerabilities. It also involves the integration of climate risks into the preliminary studies required for the creation of a new area.	<ul style="list-style-type: none"> • Government • Local authorities • Developer • Planning bodies • IZ managers • Civil society
Development	At the development stage, it is important to consider, for example, building materials that are resilient to high temperatures and heavy rain, technologies to optimise water and energy supplies in a sustainable manner, or appropriate infrastructure design.	<ul style="list-style-type: none"> • Government • Local authorities • Developer • Planning bodies • IZ managers
Management	At the management stage, adaptation means the strategic integration of climate risk into the management of industrial areas, in order to reduce and control the potential impacts of climate change on space and businesses. This integration must take place both internally within the IZ management and externally - in the context of industrial and local development policies.	<ul style="list-style-type: none"> • IZ managers • Local authorities • Businesses
Retrofitting	At the retrofitting stage, integrating infrastructure measures will make it possible to reduce the exposure of an existing industrial area to climate risks, or to strengthen the management capacities	<ul style="list-style-type: none"> • IZ managers • Local and elected local authorities • Developer • Planning bodies • Government • Businesses

2. Climate Change in Morocco: Trends and projections

2.1 An inevitable climate change in Morocco

Morocco has been identified as a **country very vulnerable to the CC** (by the Intergovernmental Panel on Climate Change (IPCC) in its 4th report in 2007).⁸ Climate change increasingly affects the country's water resources, agricultural production, coasts and cities. The main effects of climate change on Morocco are:

- the rise of average temperatures
- the change in precipitation
- the rise the sea levels
- droughts and the increasing scarcity of water



Flooding in the Oued Beni M'Hamed
Photo: DRETL Souss Massa 2014

⁸ IPCC, 2007: Climate Change 2007: Synthesis Report. IPCC, Geneva, Switzerland, p. 9.

- **floods and storms**

In addition, climate phenomena such as cold waves, high winds, lightning, snowfall, hail, sandstorms, land movements and locust invasion also affect Morocco.

These effects of CC particularly influence the semi-arid and arid areas of southern Morocco (south of the Atlas), amplifying drought trends and disrupting the agriculture of its regions, which are essential for the national market and for exports. The risks of rising water levels, and erosions particularly affect the 3500 km of coastline thus affecting all the infrastructure in the urban coastal area. A large number of Moroccan economic and demographic centres located on the seaside are in vulnerable areas. These effects directly affect many people, but these impacts also represent a challenge for the private sector and in particular SMEs, Morocco's main economic driver.

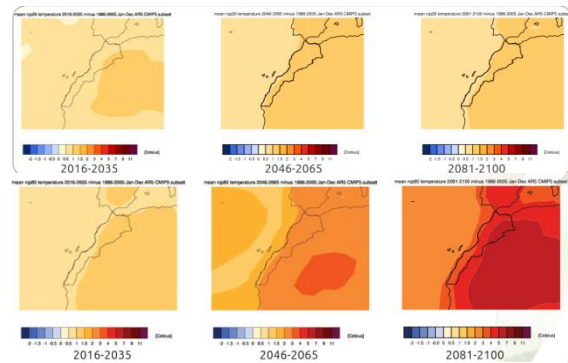


Erosion of Bouznika beach due to heavy swells in January and February 2014.
Photo: 3rd national communication

2.2 A visible gradual change

Rising temperatures:

Since the 1960s, average annual temperatures have increased by 1.0°C to 3°C across Morocco. Projections show an upward trend in annual average temperatures of 0.5°C to 1°C by 2050 and 2080 for the "optimistic" scenario; and an upward trend of 4 to 5°C or even 7°C by 2100 for the "pessimistic" scenario (3rd National Communication, Morocco, 2016).



International context: CC is a global issue that affects the world in an uneven way. During COP21 in Paris in 2015, the international community has committed itself to reduce GHG emissions in order to hold the average temperatures increase below 2°C compared to the beginning of the industrial era. In addition to mitigation policies, individual countries develop National Adaptation Plans (NAPs) that define medium- and long-term adaptation goals, and set national strategies and programmes to address the needs. The monitoring of these adaptation commitments is coordinated at the international level by the UNFCCC.

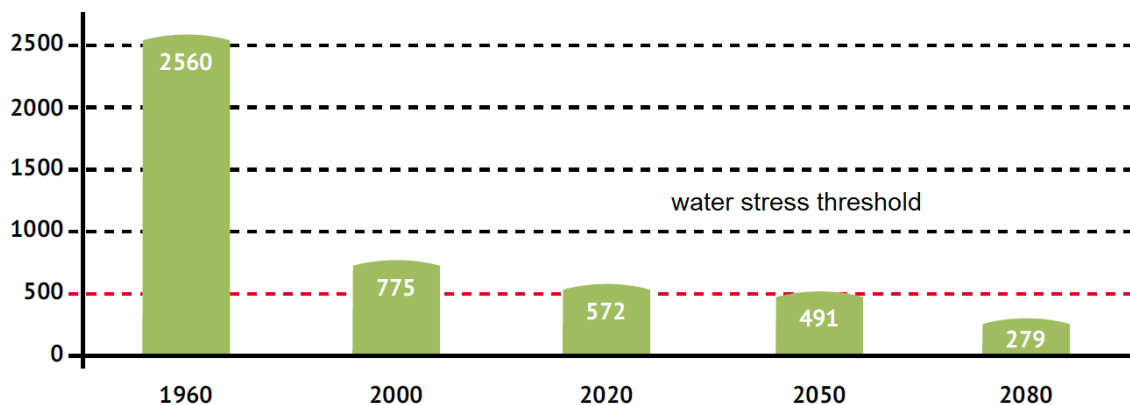
Declining and more irregular rainfall:

Rainfall has decreased by between 3 and 30% with an average decrease of 26% in the north-western region of the country. There is also a changing rainfall pattern with more frequent and concentrated heavy rains, particularly between October and November. Projections predict a decrease in cumulative annual rainfall of between 10 and 20% with a decrease of up to 30% in the Saharan provinces by 2100 in the "optimistic" scenario and up to 40% in the "pessimistic" scenario (3rd National Communication, Morocco, 2016).

Scarcity of water resources:

There is evidence that water resources, particularly in basins, are significantly reduced compared to 1990, with a water shortage expected between 2020 and 2050 (3rd National Communication, Morocco, 2016).

Projection of water availability (m³ / inhabitant / year). Average of optimistic and pessimistic scenarios calculated by extrapolating the results of two basins 3rd national communication, Morocco 2016 after Sinan M, and Belhouji A, 2015



Sea level rise:

On the Mediterranean coast of Morocco, the sea level rose by about 0.6 mm per year over the period 1945 to 2000. On the Atlantic coast, an increase of between 1.6 and 2 mm/year was observed over the period 1955-2003. In addition, Moroccan beach surfaces are shrinking and sea conditions are becoming more dangerous. The IPCC predicts an increase in sea level from 18 (today) to 59 cm by the end of the 21st century (3rd National Communication, Morocco, 2016).

2.3 More frequent climatic extremes

High temperature variations and more frequent heat waves:

Heat waves are becoming more frequent and longer, with temperatures reaching up to 47- 48°C in some years. Cold waves are also visible, particularly in the High and Middle Atlas regions.

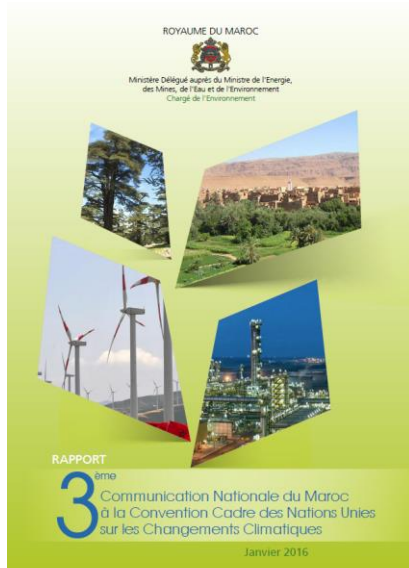
More frequent and prolonged droughts:

Before 1900, drought episodes occurred every 5 years. From 1990 to 2000, they occurred every 2 years (Burger 2014). The most pessimistic scenario projects 5 months of drought from April to September with an average of less than 5mm of precipitation for a little more than one month between 2020 and 2039. The optimistic scenario forecasts periods of more than 70 days from April to July without rain at the end of the century (World Bank).

Floods and heavy rains more and more frequent:

In the Souss Massa region, for example, there has been a sharp increase in the number of floods: there were 4 floods in the 25 years between 1982 and 2007, whilst there have been 7 floods in the period of 2008 to 2015 (Moroc Météo 2015).

Projections show rainfall intensity variations ranging from minus 16% to plus 34%. (Climate Service Center Germany 2013).



Morocco's 3rd National Communication to the United Nations Framework Convention on Climate Change, published in January 2016, outlines the challenges that CC represents for society, the economy and Moroccan biodiversity and describes the strategies already put in place and those that will be put in place to reduce the various climate risks for the country.

<https://unfccc.int/sites/default/files/resource/Marnc3.pdf>

3. Climate risks and opportunities

Climate change poses significant challenges to economic actors. Even in the case of a significant reduction in GHG emissions, some effects of climate change such as the increase in extreme events are inevitable. This implies that IZs and companies must adapt their environment and processes to climate change. This adaptation poses new challenges for private sector actors but also offers new opportunities.

3.1 How are industrial zones affected?








The majority of companies interviewed as part of our work in Morocco report that the effects of climate change have already affected them. Many people consider heavy rains, wide temperature variations and heat waves as the most worrying climate phenomena. For example, in the agro-industry sector, companies see their production costs increase due to problems related to water scarcity or rising energy prices. Furthermore, they have already suffered costs for material following the flooding of buildings or storage warehouses, as well as losses in turnover due to irregularities and/or disruptions in the supply chain or logistics. In addition to the visible impacts at the enterprise level, industrial zones are affected in terms of their operation, infrastructure and, where a management structure exists, services provided to companies. In the Ait Melloul IZ, there has already been material damage to roads, signs, lighting due to heavy rains, and access to the IZ was blocked for several hours due to flooding.

The impacts of climate change differ from one IZ to another, depending in particular on:

- **Location of the area:** In Morocco, there are different degrees of vulnerability between regions. For example, coastal areas are particularly vulnerable to rising sea-levels and coastal erosions, and arid regions in the south are more vulnerable to drought events.
- **The state of the IZ:** The impact of a climate phenomenon on a poorly planned and managed industrial area will certainly have far more serious consequences than on a well-planned and/or managed IZ. For example, roads in poor condition will suffer more damage than well-maintained roads; appropriate zoning in an IZ can help protect fragile infrastructure in the event of flooding.
- **Sectors represented:** Some sectors are more vulnerable than others - for example, IZs dominated by agro-processing are highly dependent on agriculture, one of the sectors most affected by climate change and water stress in the country. Any disruption in agricultural production can lead to disruptions in the supply chain.

In Morocco, more than 80% of industrial areas are old or from the 1990s⁹: These areas, which are often poorly planned, organized and without a strong management structure, are more vulnerable to climate change than the new generation of IZs, which are better planned areas with modern infrastructure and more professional management.

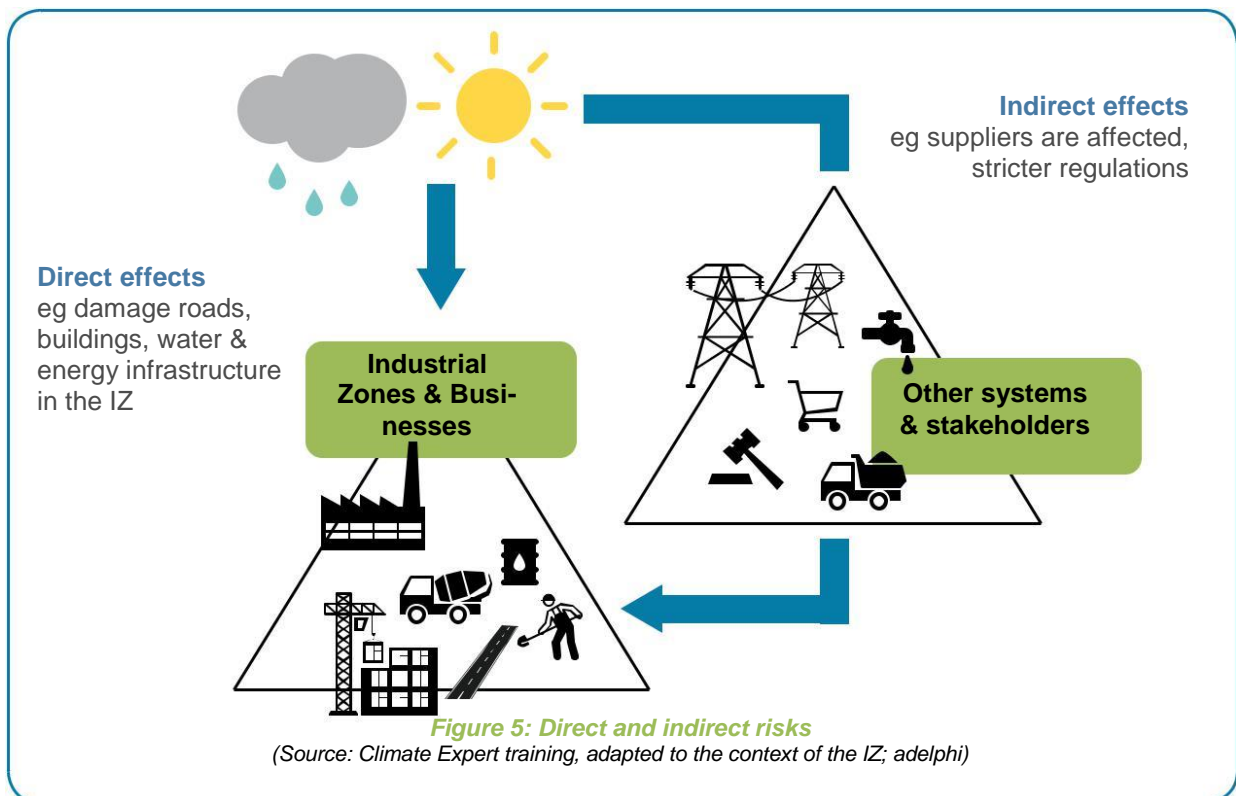
Table 4: Examples of consequences / damages resulting from climate change on industrial zones and businesses

Climate phenomena		Examples of consequences/damages
	Temperature increase	The exposure of buildings and roads in the industrial zone to high temperatures and sunlight cause cracks and deformations. This may involve renovation costs and traffic problems in the area.
	Decrease in precipitation	An average decrease in rainfall reduces the water level of dams that can no longer provide energy sustainably. The electricity supply in an area can be disrupted.
	Drought and scarcity of water resources	Water resources are increasingly scarce, leading (national and regional) authorities to regulate groundwater withdrawal for industrial purposes very strictly. The cost of water will increase for manufacturers, which will affect production costs.
	Heat waves	Employees working in IZs suffer from high heat and lack of fresh air, their productivity decreases and they are more and more sensitive to illnesses. Business productivity is affected.
	Flooding and heavy rains	In the event of heavy flooding, access to the IZ can be disrupted; employees and logistics partners can no longer access the area. All the activities of the IZ are affected.
	Rising sea levels	IZs near the coasts lose land due to erosion of land by the sea and their infrastructure is damaged by waves.
	Storms and strong winds	Thunderstorms can lead to considerable infrastructure damage that results in significant renovation costs for the IZ and serious losses for businesses. The entire IZ and businesses are affected.

⁹ Orientation guide for the transition to Sustainable Industrial Zones in Morocco. For the use of Industrial Zone actors; Ministère délégué auprès du Ministre de l'Énergie, des Mines, de l'Eau et de l'Environnement, chargé de l'Environnement and GIZ.

3.2 What are the potential risks?

Risks can be direct or indirect.

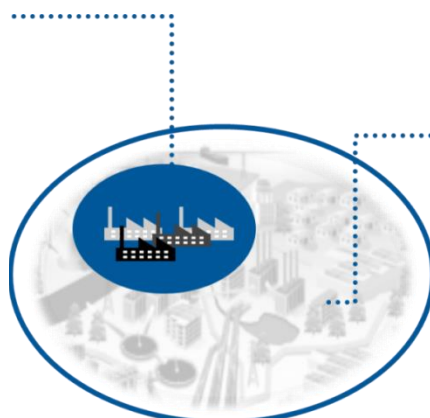


Direct risks cause physical damage to infrastructure and production sites. Examples include material damage to roads, signage and lighting due to floods or storms, or contamination of water and soil due to flooding of hazardous material or waste storage sites.

Indirect risks represent the consequences of damage caused to external systems, outside the control of the industrial zone. Examples of indirect risks include a decrease in production in the zone due to a power outage in the city during heat waves or floods, or the relocation of companies in the area due to recurrent flooding in the area.

Examples of risks specific to companies

- Water scarcity that interrupts operations
- Material damage to physical assets (machines; buildings)
- Supply chain disruptions
- Irregularities in the supply chain / Shortage of raw materials
- Employees in poor health
- New and stricter CC-related regulations



Examples of risks specific to Industrial Zones

- Irregularities in water and energy supply
- Blocking of activities in the area due to damaged infrastructure
- Water/soil contamination
- Damage to infrastructure and buildings in the industrial zone
- Conflicts with neighbouring communities
- Departure of businesses to better adapted IZs
- Health of surrounding populations (Chemical contamination)



Climate risks and adaptation strategy: the experience of the enterprise “Nouvelle AVEIRO Maroc” in the fish-canning sector

"SMEs are directly affected by the impact of climate change and so is our company. We were supported by the GIZ to develop an adaptation strategy for CC using its Climate Expert approach, which made it possible to identify climate risks, assess them, prioritize as well as to identify corresponding adaptation measures and to prioritize them, particularly through the use of cost/benefit analyses. Thanks to this support, we have identified three major risks that our company can face: disruptions in water supply, disruptions in raw material supply, and regulations that will become increasingly strict and must be anticipated. The measures identified will be integrated into our corporate strategy".

Noureddine Khay
 Directeur d'Exploitation d'AVEIRO Maroc
 Nouvelle Aveiro Maroc
(translated for this guide)

3.3 What are the opportunities?

In a 2015 Accenture/Global Compact global survey¹⁰ of 270 large companies, more than half of executives believe that climate change presents opportunities for growth and innovation over the next 5 years. Climate change not only presents risks but also creates commercial opportunities for businesses and industrial zones as a whole.

Examples of opportunities specific to companies

- Develop new product and service lines to meet new demands created by the CC
- Reduce operating costs through more efficient use of resources
- Improve reputation
- Developing new skills for the future
- Anticipate new regulations



Examples of opportunities specific to industrial zones

- Reduction of maintenance and operating costs (e.g. common waste management, central supply of renewable energy, etc.)
- Improve the image of the IZ and attract new investors
- Ensure the proper functioning of services and infrastructures over the long term
- More varied services for companies

¹⁰Source: The UNGC - Accenture CEO Study "Special Edition : A Call to Climate Action" (November 2015)

4. Becoming an industrial zone resilient to climate change

4.1 Integrate climate risk into the management of industrial zones

There are a variety of approaches to adapt to climate risks, depending on the degree of anticipation and integration of climate risk management within an organization's strategy. Some organisations will opt for **reactive adaptation**, with specific measures put in place after the damage has occurred. Others will **anticipate the risk** and implement measures to try to minimise the risks. Other organisations will go further: through **integrated adaptation**, they will anticipate risks and integrate adaptation measures into their strategies, thus being able to improve their chances to realise adaptation opportunities. Through an integrated approach to climate risk, industrial zones are becoming key players in strengthening the resilience of areas and companies. The integrated approach is comprised of four areas:

- **Integrating climate risk into risk management/monitoring systems:** Due to the concentration of companies, industrial zones are directly concerned by risks, whether for problems of interactivity, the use of public spaces or the potential impact on neighbouring populations. IZ managers have a key role to play in anticipating risks. They can thus encourage the search for collective solutions and promote risk prevention among companies.
- **Strengthening the resilience of the IZ while improving the management of IZ operations:** By engaging in an adaptation process, IZs benefit from positive side effects that directly affect the management of operations. For example, as part of retrofitting plans, investing in improved drainage systems and better waste management to avoid flooding risks will allow the IZ to optimize its operations and even reduce some costs.
- **Integrating climate risk into the application of sustainability standards:** Many technologies or adaptation measures often meet sustainable industrial development objectives, such as efficient resource management or the implementation of joint waste management. Adaptation should be closely linked to the quality and sustainability policies put in place within the IZ (e.g. high quality environmental standards or SIA guidelines)
- **Integrating adaptation into the offer of services to companies:** IZ managers can support companies in their adaptation efforts by providing a variety of services such as training, access to climate data, access to a network of adaptation experts, or even support them in their risk analysis.

By following this transversal and integrated approach, industrial zones can reduce their vulnerability to CC while increasing the competitiveness of their space and their companies.

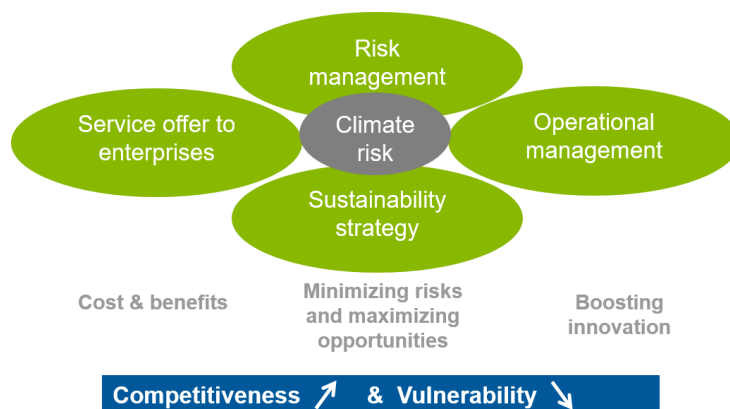


Figure 6: Integration of climate risk into the management of an industrial zone

4.2 Climate impact areas and risks

Based on the experiences and lessons learned from the pilot phase of the PSACC project, a series of impact areas specific to industrial areas were identified. The classification below is the result of a participatory approach and has been defined in collaboration with a broad representation of companies and industrial areas. Detailed explanations on each impact area as well as concrete examples of risks are provided in the technical data sheets in the appendix¹¹. These technical sheets are a tool to support vulnerability studies.

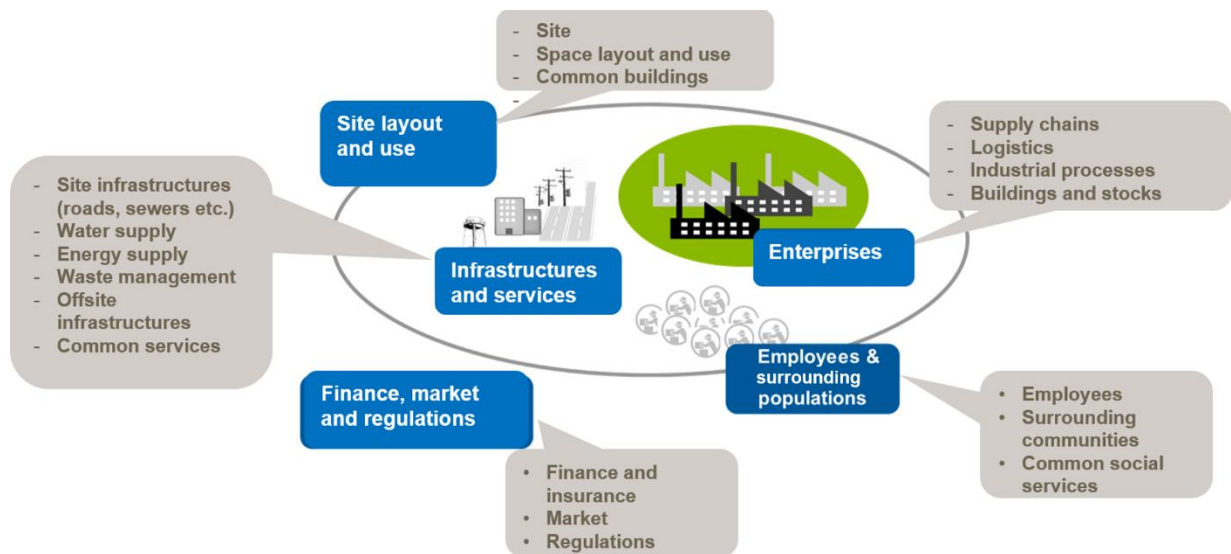


Figure 7: Impact domains and subdomains of an industrial zone

The impact areas are presented in detail in the table below. There are 5 major impact areas divided into sub-domains.

Table 5: Impact areas of an industrial zone

Areas of impact	Potential risks
 <p>Site and use of the space</p>	<p>Site</p> <ul style="list-style-type: none"> • Risks related to the site itself and the location of an industrial zone. e.g. geographical location, access to water, distance from coasts, rivers <p>Spatial planning and use</p> <ul style="list-style-type: none"> • Risks related to the architectural design and development of the IZ. e.g. resilience and road conditions, the existence of air corridors • Risks related to the overall design of the IZ, e.g. presence of water intake points, green spaces, the utilisation of certain infrastructure/building materials • Risks related to the activities of the IZ and their distribution in the entirety of the area. e.g. no zoning

¹¹ These are currently only available in French but can be translated on demand. Contact GIZ using the contact details on the Climate Expert website to discuss.

Common buildings

- Risks related to the closure and damage of common areas for companies depriving players in the industrial zone of the services offered such as banking, post office, insurance, receptions
- Risks related to buildings belonging to the IZ, in particular for IZs that offer leased lots



Infrastructure and Services

On-site infrastructure

- Risks related to the damage or the blocking of the physical infrastructure of the IZ e.g. blocked roads or evacuation systems following extreme climatic events
- Risks related to inadequate infrastructure management. e.g. poor maintenance of drainage systems

Water supply

- Risks related to low or no flow of water on the IZ following damage to the water supply network
- Risks related to increasing water demand and changing resource availability. e.g. declining groundwater levels

Energy supply

- Risks related to power outages of varying lengths and short circuits due to extreme weather conditions, e.g. flood, storm, heat wave and increasing energy demand
- Risks related to the structure of the electricity grid and its maintenance

Waste management

- Risks related to the long-term accumulation of waste that can cause epidemics and floods.
- Risks related to inadequate waste management, e.g. chemical contamination during floods

Off-site infrastructure

- Risks related to the blocking or damage of transport routes upstream of the IZ due to the effects of CC, e.g. pavement deformation by extreme heat, or floods

Other infrastructure and common services

- Risks related to the damage of the infrastructure necessary for the proper functioning of the industrial zone. e.g. signalling, traffic lights



Companies

Supply chain management

- Risks related to the effects of CC on the production of suppliers to companies in the industrial zone, e.g. defective or inferior raw materials, insufficient or delayed production
- Risks related to impacts on the supply chain, particularly for sectoral industrial zones

Logistics

- Risks related to the exposure of products to climatic effects during transport. e.g. sand, temperatures, rain
- Risks related to the disruption of logistics circuits, e.g. late delivery and late penalties

Industrial processes (including equipment and machinery)

- Risks related to the damage to production equipment and machinery that can lead to production stoppages. e.g. overheated or flooded machines

Buildings and stocks

- Risks related to the damage to company premises, e.g. floods, heat cracks, refrigerator stops, data loss
- Risks related to the exposure of stock, such as raw materials, equipment or finished products due to bad weather, e.g. floods or rotting during high temperatures



Employees and surrounding populations

Employees

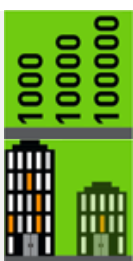
- Risks related to employees' working conditions and which may have an impact on productivity. e.g. exposure to temperatures, ventilation or not of the workplace, presence or not of rest areas,
- Risks related to hazards affecting employees. e.g. illness and need of evacuation of the area in an emergency.

Surrounding population

- Risks related to pollution hazards or chemical contamination for neighbouring population from the IZ
- Risks related to conflicting interests between the IZ and surrounding population, e.g. resource use.

Common social services

- Risks related to the interruption or a lack of public services on which the IZ and the inhabitants depend, e.g. public transport, hospitals



Finance, Market and Regulation

Finance and insurance

- Risks related to possible financial difficulties to which an industrial zone and companies could be exposed to as a result of the effects of CC
- Opportunities related to new funding available for ACC
- Risks related to possible environmental responsibilities towards neighbouring populations

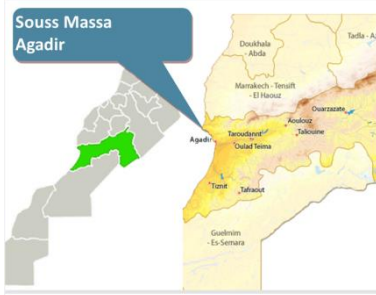
Marketplace

- Risks related to the loss of competitiveness due to the creation of new, more modern and resilient industrial zones in the CC. e. g. departure of companies to another industrial zone
- Risks related to the loss of markets of majority companies in the IZ, e.g. change in demand, products that no longer sell during the same conventional period in a traditional market

Rules and regulations

- Risks related to the strengthening of CC-related laws and adaptation that can lead to significant investments for the IZ, e.g. increasing requirements in terms of climate risk prevention e.g. concerning choice of site, infrastructure, buildings, etc.
- Risks related to the strengthening of CC-related laws and adaptation that can lead to significant investments for companies, e.g. new regulations to save water resources, energy efficiency, limit environmental impacts

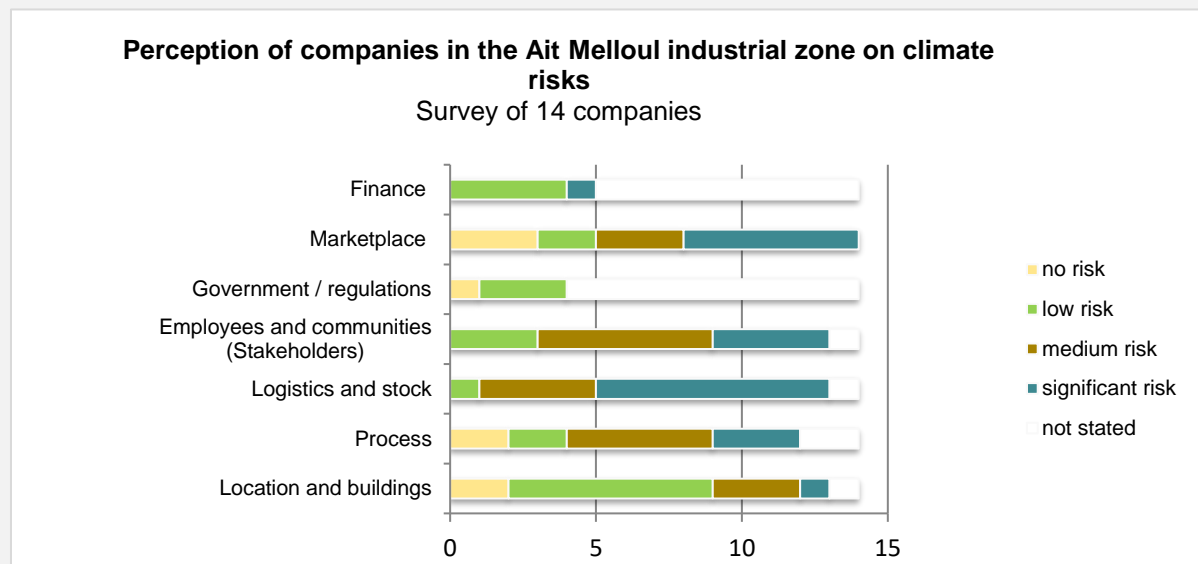
Box 2: Ait Melloul IZ case study - How is Ait Melloul IZ affected by climate change?



The exposure of the IZ to climate change is important, considering its geographical location, the problems faced by its infrastructure and the vulnerability of its main stakeholders. Temperature increases as well as bad weather, storms, heat waves and droughts becoming more frequent are among the climate phenomena that most severely affect the infrastructure and activities of the IZ in Ait Melloul. Frequent floods have caused logistical problems in Ait Melloul, such as damage to equipment and infrastructure, and also blocking access to some businesses. During heat waves, electricity cuts interrupt industrial activities and lead to lower productivity. The agro-food and seafood industries consume a lot of water and are therefore particularly sensitive to the water scarcity that the Souss Massa region has seen. Finally, the competitiveness and viability of the majority of companies in the area have been affected since the supply chains of food and fish processing have been vulnerable to climate change.

tries consume a lot of water and are therefore particularly sensitive to the water scarcity that the Souss Massa region has seen. Finally, the competitiveness and viability of the majority of companies in the area have been affected since the supply chains of food and fish processing have been vulnerable to climate change.

Risks for companies



Examples of risks identified by companies

- Damage to buildings and loss of finished products due to flooding
- Disruption of agricultural supply due to damaged roads
- Decrease in the quality and availability of agricultural and fisheries products
- Disruptions in water supply and increase in water prices
- Disruptions in electricity supply due to power outages
- Decreased worker productivity and absenteeism during periods of high heat
- Stricter regulations leading to costly investments

For the companies in IZAM that depend mainly on the agricultural and fisheries sector, supply chain risks are a priority. Agro-food companies reported that they were increasingly affected by agricultural production problems (reduced production or quality). Fish canning companies are also affected by the increasing migration of fish to the southern coasts of Morocco or by fish delivery problems (due to roads blocked during bad weather). Furthermore, process risks exacerbate the problem (particularly water supply risks), as well as material risks (such as damage to premises, stocks or IT equipment during

floods). While some companies mentioned a 5% decrease in employee productivity during the increasingly frequent heat waves, this aspect does not represent a major risk for most of the companies. The project process confirmed these first impressions from businesses. However, the "regulations" aspect, which had not been identified as a priority at the beginning of the investigation, emerged as another major risk during the process. Indeed, companies are now confronted with stricter environmental regulations that are currently generating or will generate significant investments for manufacturers.

Identified climate risks in the industrial zone

Impact areas	Identified climate risks
Site	<ul style="list-style-type: none"> • Flooding of the site causes damage to infrastructure, buildings and interruption of the industrial activity
Infrastructure and services	<ul style="list-style-type: none"> • Irregularities in the supply of water due to water scarcity and overexploitation of groundwater • Blocked sewage network causing flooding of roads and premises of enterprises and disrupting logistics throughout the whole IZ • Frequent power outages during heat waves and floods causing the interruption of industrial activities • Damage to the roads inside and outside the IZ blocking the access to the area leading to logistical problems • Risks of water and product contamination due to weak waste management
Companies	<ul style="list-style-type: none"> • Interruption of the supply chain of most companies in the IZ • Disruptions in the delivery of products leading to penalties for export industries • Blocked access to the factories • Damage to material (eg equipment, machines) • Loss of stocks of raw materials and finished products during floods
Employees and surrounding populations	<ul style="list-style-type: none"> • Absenteeism of employees who are unable to travel to their workplace • Interruption of public transport used by employees • Decrease of productivity during periods of high temperatures • Risks for employees
Market, finance and regulation	<ul style="list-style-type: none"> • Stricter regulation in the areas of water, waste and energy management • Competition of other industrial areas

Source: GIZ-PSACC project, vulnerability analysis of the Ait Melloul industrial zone

4.3 Adapting: An overview of adaptation strategies and measures

Table 6: Types of adaptation measures


Types of measures	Description
 <p><i>Photos: ukfbinternational.com</i></p>	<p>Technical and infrastructural measures (grey measures)</p> <p>These are technical and infrastructural solutions to reduce the vulnerability of a space or company</p> <p><i>Examples:</i> Flood or storm-resistant constructions/buildings, physical doors or barriers against floods, system optimizing the water consumption, building insulation.</p> <p><i>Features:</i> Immediate solution, medium and/or long-term amortisation</p>



Photo: geograph.org.uk

Ecosystem-based measures (green measures)

These are ecosystem-based solutions such as water and trees to enhance the resilience and adaptive capacity of a system

Examples: Installation of rainwater storage areas (e. g. a meadow can be used as a floodplain to channel water away from factory buildings), creation of green spaces using the planting of trees, green roofs or green walls

Features: Low cost and more flexible solutions compared to technical measures



Photo: [adelphi](#)

Management measures, non-infrastructure (soft measures)

These are "soft" solutions such as raising awareness or integrating climate risk management into management processes and institutional structures.


Examples: raising awareness among companies, monitoring environmental and climate change policies, flood risk insurance, employee training, setting up monitoring and evaluation systems, etc.

Characteristics: measures to strengthen internal skills and capacities to cope with the impacts of climate change


The tables below provide examples of adaptation measures to enhance the resilience of established or existing industrial areas. The proposed measures are to be implemented at the level of the IZ and not at the level of individual companies. These are measures relating to the management and rehabilitation of an industrial zone, and not to planning. As in the previous section on risks, the measures are linked to the different impact areas of an industrial zone. The proposed measures are also classified by type of measure, as presented above and according to the following colour code:

Grey measures = Technical and infrastructural measures	Green measures = Measures based on the eco-systems	Soft measures = Management and non-infrastructural measures
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Table 7: Examples of adaptation measures by impact area

 Site and use of space
Site
<ul style="list-style-type: none"> • Flood protection wall/enclosure buried in the ground which can be raised in • Flood-proof mobile dam for waterproof pipes that can be quickly installed in flood-prone areas


Development and use of the space
<ul style="list-style-type: none"> • Drainage elements facilitating the infiltration of rainwater (such as gravel, paving stones, grass) in tarred or concreted areas • Urbanization that allows for air circulation, creating air corridors or protection from strong winds • During retrofitting, review the zoning of the IZ • When retrofitting the area, take into account the impact of wind and sunlight on buildings
<ul style="list-style-type: none"> • Grassy ditches, natural or man-made, to act as buffer zones for excess water • Use of open spaces as a reservoir of water • Buffer zone between forests and IZ protecting the IZ from forest fires • Green space allowing the cooling of air
Common buildings
<ul style="list-style-type: none"> • Insulation of buildings • Waterproof bricks allowing the airing of the building but preventing the infiltration of water • Protection door against external flooding and fire • Materials resistant to strong winds • Increase use of natural materials (e.g. wood) and lightly coloured materials that store less heat • Raising buildings to avoid flooding
<ul style="list-style-type: none"> • Green roofs help absorb rain and reduce the impact of outside temperatures
<ul style="list-style-type: none"> • Building planning. e.g. the voluntary flooding of certain premises, reduces pressure on the building structure and avoids major damage

 Infrastructure and services
On-site infrastructure
<ul style="list-style-type: none"> • Sewer closures and wastewater drainage system to prevent flooding, contamination and possible backflow • Retention basins to store rainwater for flood control. • Overflows for thunderstorms linked to a water development that directly discharges excess water • Trenches and drainage wells capable of temporarily storing rainwater • Setting-up trees and wind protection walls
<ul style="list-style-type: none"> • Water points allowing the cooling of air • The presence of trees and drought-resistant plants helps to reduce the drying-up of the soil and allows the cooling of the air
<ul style="list-style-type: none"> • Provide funding for the upgrading of infrastructure to conform to certain standards • Regular control of the ground fixing of mobile elements (eg warning and information signs, flower-pots)
Water supply
<ul style="list-style-type: none"> • Rainwater collection tank installed on the surface or buried in the ground, which can be connected to the gutters, allowing water to be reused • Various water filter systems allowing the reuse of water independently of the local water supply network

<ul style="list-style-type: none"> • Installation of a solar powered water pump
<ul style="list-style-type: none"> • Installing a central water consumption monitoring system
Energy supply
<ul style="list-style-type: none"> • Installation of light bulbs with low consumption and thus saving electricity • Photovoltaic solar panels or water heaters installed on roofs or solar-powered lighting in the industrial zone
<ul style="list-style-type: none"> • Natural and clear materials (such as wood) that do not store much heat • Cooling and ventilation of buildings using heat pumps
<ul style="list-style-type: none"> • Management of electricity consumption to avoid complete shutdown of electrical systems during periods of excess demand or short circuits
Waste management
<ul style="list-style-type: none"> • Waste treatment plants
<ul style="list-style-type: none"> • Cleaning of sewage pipes before and after a rainy period facilitates the flow and reduces the risks of floods • Proper and effective waste management avoids clogging of pipes and reduces the effects of heat on the industrial zone
Off-site infrastructure
<ul style="list-style-type: none"> • Permanent contacts and exchanges with road management authorities • Permanent contacts and exchanges with managers responsible for water and electricity networks
Other infrastructure and common services
<ul style="list-style-type: none"> • Preserve and safeguard important documents of the IZ in safe places • Adapt the activities of the IZ to predicted weather events to avoid material damage and human casualties • Install warning system to be informed about weather events; then inform and react in time • Engage in a dialogue on climate change with all stakeholders

	Companies
Supply chain management	
<ul style="list-style-type: none"> • Identify alternative supply routes in case of blocked roads • Provide technical support or guidance (awareness, training) to suppliers in priority sectors of the IZ • Inform companies about different adaptation options at the supply chain level (e.g. supplier diversification) 	
Logistics	
<ul style="list-style-type: none"> • Identify alternative delivery routes in case of blocked roads • Encourage companies to develop storage facilities to reduce dependency on last-minute deliveries • Encourage companies to adopt flexible delivery logistics 	

Industrial processes (including equipment and machinery)
<ul style="list-style-type: none"> • Flood control systems (mobile/fixed, automatic/manual) protecting premises and machines from flooding • Use of biodiesel generator to continue the supply in case of power failure on the network
<ul style="list-style-type: none"> • Specific training courses on energy efficiency, renewable energies and sustainable water management in the company • Implementation of the evaluation system and monitoring of water and electricity consumption in the industrial zone
Buildings and stocks
<ul style="list-style-type: none"> • Automatic or manual flood barriers with adjustable sizes and heights for warehouses • Shading elements in buildings to protect stock from sunlight and bad weather (rain and sand)

	Employees and surrounding population
Employees	
<ul style="list-style-type: none"> • Sun protection at buildings to protect employees from the sun 	
<ul style="list-style-type: none"> • Shaded areas allowing employees to shelter from the sun and to be exposed to more pleasant temperatures • Green roofs and walls allowing more pleasant temperatures in the workplace • Creation of green spaces at strategic locations in the industrial zone 	
<ul style="list-style-type: none"> • Awareness-raising campaign to inform companies and stakeholders of the various risks in order to avoid accidents and sickness • Establishment of an emergency escape route system to enable access to the area and evacuations • Encourage companies to implement new work schedules to prevent employees working outdoors from being exposed to high temperatures 	
Surrounding population	
<ul style="list-style-type: none"> • Sealing of sewage pipes preventing contamination of the water of neighbouring populations • Retention basins to protect populations downstream from possible flooding • Electricity produced by solar panels on site that can be used by neighbouring populations 	
<ul style="list-style-type: none"> • Green spaces on the IZ to also benefit neighbouring populations 	
Common social services	
<ul style="list-style-type: none"> • Implementation of public transport serving the whole area and connecting it to urban areas • Installation of a first aid centre within the IZ capable of preventing, controlling and intervening if necessary 	



Finance, market and regulation

Finance and insurance

- Take out insurance to protect the IZ from financial losses in the event of disasters
- Monitoring and informing companies about ACC funding opportunities

Marketplace

- Develop a communication strategy around the IZ's commitments to ACC

Rules and regulations

- Regularly monitoring of new laws, CC-related guidelines and support programmes for industrial zones and companies
- Training on regulations and their application to companies.

Adaptation measures and sustainability aspects

Adapting is part of the logic of developing a Sustainable Industrial Zone and is an integral part of the approach promoted by the GIZ within the framework of the SIA guidelines. Indeed, the examples of adaptation measures above show that by strengthening the resilience of an industrial zone, we can implement a variety of measures that will accompany the transition to a sustainable industrial zone.

- In selecting adaptation measures, it is imperative to opt for sustainable and environmentally friendly solutions (poor adaptation vs. good adaptation). Thus, we recommend approaches of industrial symbiosis and resource efficiency promoted within the framework of sustainable industrial zones.
- The themes of adaptation and mitigation are linked. While their objectives are quite distinct, in order to adapt, it is essential to consider mitigation measures. Some mitigation measures may indeed contribute to the resilience of industrial zones. For example, energy efficiency measures and renewable energy offer the possibility for at-risk industrial areas to safeguard energy supplies and ensure a pleasant ambient temperature conducive to good employee productivity.
- In the context of adaptation, we recommend considering a holistic approach to sustainability. Indeed, besides environmental aspects, social and organisational aspects also play an important role.

Box 3: Case study Germany, Bottrop: Example for the adaptation of two industrial zones

The Future Cities programme has enabled the Emschergenossenschaft cooperative and the municipality of Bottrop to implement measures to adapt to climate change within two former industrial zones, Scharnhölzstraße and Boytal. Projections for the region predict a decrease in the number of cold days and a 2-day increase in the number of days of extreme heat. Rainfall patterns are also expected to change.



Photo: Future Cities (2013): *The Future Cities guide. Creating liveable and climate-proof cities. EU – Interreg IVB North-West Europe Programme (NWE).*

Climate phenomena	Impact areas	Risks identified	Implemented adaptation measures	Opportunities
Flooding	Site and use of space	Industrial zone cannot absorb water in case of heavy rain due to the use of concrete	Measures to allow absorption of water	
	Infrastructures	Open drainage system to a nearby lake that is only connected to the sewage system	Creation of trenches to separate the natural flow of water from that of wastewater, and to facilitate rainwater to flow out of the industrial zone	The quantity of water to be processed has decreased
Heat waves and rising temperatures	Site and use of space	Industrial area largely covered in concrete causing the area to heat up excessively	Development of green spaces Development of green roofs for buildings with sufficiently strong roofs	
Overall			Installation of solar panels Reuse of rainwater re-use Development of a "Guide for Climate Change" to analyse climate vulnerability and to increase stakeholder awareness	Production of energy for the use of industrial activity Creation of new water sources for the IZ An image that is positive and "responsible" for the Emschergenossenschaft Participate in an international urban exchange network

Source: Future Cities (2013): *The Future Cities guide. Creating livable and climate-proof cities. EU – Interreg IVB North-West Europe Programme (NWE).* pp. 64 – 66.

Section B: Implementing an adaptation strategy

Photo: GIZ



This section is dedicated to the implementation of an adaptation process in an existing industrial area. It includes tools and a step-by-step approach to support IZ managers in this process and addresses the following questions:

- How to start a process of adapting to climate change for an IZ? What are the main steps and how can this process be operationalised?
- Which actors should be involved and how to win their commitment?
- What tools and resources are available to assist IZ managers in risk analysis and adaptation measures?
- What are the prerequisites for implementing an adaptation strategy?



"Industrial zones are often seen as causing a large part of the greenhouse gases emitted by human activity. However, these same industrial areas are also exposed to the effects of the resulting climate change, which will increase in the future. Anticipating these changes and taking into account their impacts must be integrated from the design of the areas to their retrofitting; the survival of companies and the maintenance of jobs depend on it. To this end, this guide represents a real tool that will enable our zones to structure their thinking, to integrate climate risk management, but also the resulting opportunities into their action plans."
(Quote translated for this guide)

Mounir BENYAHYA, President of the COZINE

5. A variety of actors involved

Launching an adaptation process is a complex, multidisciplinary and multi-dimensional project that requires significant efforts in communication, coordination and cooperation to achieve sustainable solutions. IZ managers or management structures, which are the real orchestra conductor within the industrial zones, have a central role to play as leaders and coordinators.

Indeed, a variety of private, public and associated actors interact in an industrial zone, and their roles vary according to the type of management. This multitude of actors can make it difficult to set up an adaptation process. In this context, a bottom-up approach - based on the experiences of companies and other users of the IZ - and initiated, coordinated by IZ managers is recommended. Adaptation can involve significant adjustments and investments, so it is essential to ensure stakeholder engagement throughout the process. Getting the support of partners is a key factor for success.

Who should be involved in the adaptation process? Before initiating an adaptation process, it is essential to have a good understanding of the local governance of the area, and the actors with whom IZ managers interact. From the analysis of climate risks to the implementation of an adaptation strategy, the actors to be involved will vary. The involvement of stakeholders may also vary depending on the type of management of the particular industrial zone. For example, in associative management systems, the voice of companies may be more important than in private management systems.

An overview of the map of local actors in the context of the adaptation of industrial zones and their roles is presented in the table below.

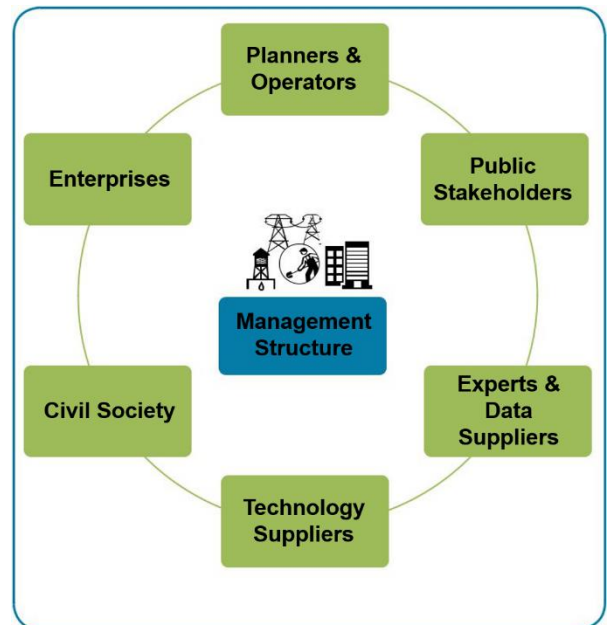


Figure 8: Types of actors involved in the process adaptation and central role of the management structure

What is the role of companies in the adaptation process?

The vulnerability of an industrial zone depends on the vulnerability of the companies located there. Conversely, without a resilient environment and infrastructure, the company cannot, on its own, cope with some of the impacts of climate change. Whether for data collection or strategy definition, companies - the primary targets of industrial zones - must be at the heart of the adaptation process. They are an important source of information and expertise for analysis. Through their involvement, their needs can be better taken into account in the definition of the strategy.

Actors Map (at the local level) ¹²

Table 8: Stakeholder maps focusing on the ACC of industrial zones in the Moroccan context

Categories of actors	Actors	Role in the adaptation process
IZ managers (management structures) and other management actors	<ul style="list-style-type: none"> • Association of businesses for industrial zone management • IZ management companies • Municipalities • Other structures e.g. agency under the supervision of the State 	<ul style="list-style-type: none"> • Leader and coordinator throughout the adaptation process
Public/State actors	<ul style="list-style-type: none"> • Regional council • Provinces • Decentralized services of ministries • Urban Agencies • Reg. Investment Centres • Civil Protection 	<ul style="list-style-type: none"> • Support of management structures throughout the process • Implementation and analysis phase (data collection or identification of measures) • Awareness-raising of stakeholders
Developers / planning bodies and operators	<ul style="list-style-type: none"> • Water: Water suppliers • Energy: Electricity suppliers • Developers / planning bodies 	<ul style="list-style-type: none"> • Analysis and implementation phase in accordance with the priorities of the adaptation strategy
Business and other private sector representatives	<ul style="list-style-type: none"> • Individual companies • Commercial and institutional banks • Professional associations • Chambers of Commerce and Industry 	<ul style="list-style-type: none"> • Analysis and implementation phase according to the priorities of the adaptation strategy • Awareness raising of companies
Climate data providers & Climate experts	<ul style="list-style-type: none"> • Weather and meteorological institutions • Universities/ research Centres • Experts/Consultants • International cooperation agencies 	<ul style="list-style-type: none"> • Analysis and implementation phase according to the priority areas
Technology suppliers	<ul style="list-style-type: none"> • Moroccan suppliers • International suppliers • International cooperation projects 	<ul style="list-style-type: none"> • Implementation phase
Civil society	<ul style="list-style-type: none"> • Local residents • Employees working in the IZ 	<ul style="list-style-type: none"> • Analysis (data collection) and implementation phase according to priority areas

The adaptation of an IZ is first and foremost a local process. However, depending on the priorities of the adaptation strategy, other actors at the national level should be considered (list not exhaustive):

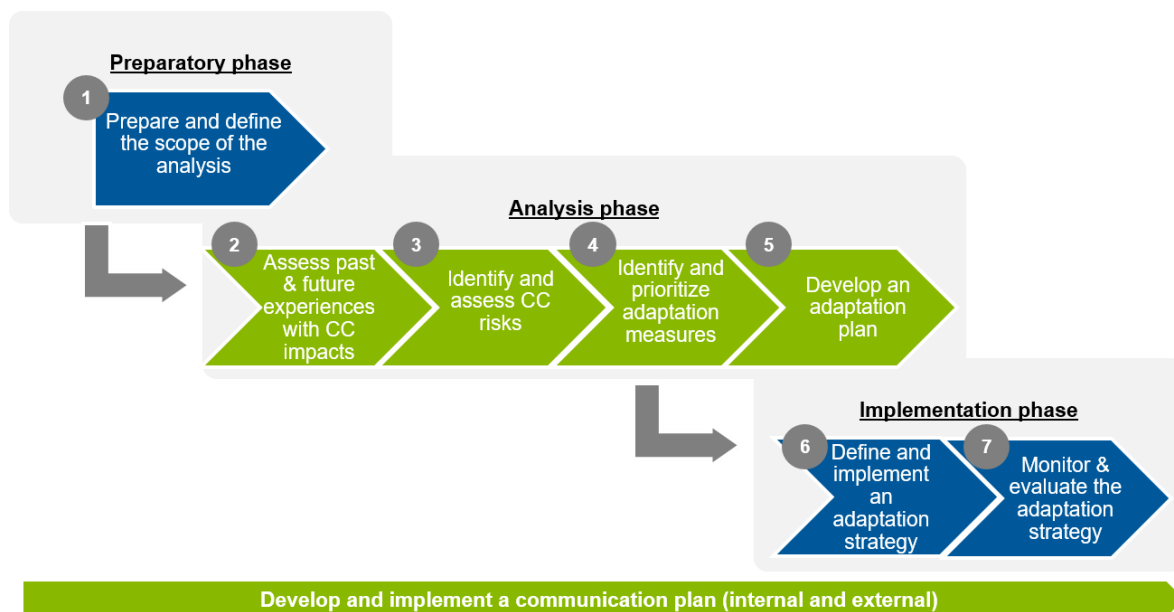
- Ministry of Industry
- Delegate Ministry in charge of the Environment
- National Climate Change Committee
- Ministry of Economy and Finance
- Ministry of Housing and Urban Policy
- Investment Development Agency

¹² Source: Based on the experiences of the PSACC pilot project and the Actors' Map of the "Orientation Guide Towards the Sustainable Transition of Industrial Zones in Morocco". For the usage of the actors of the Industrial Zones " (MEMEE, GIZ)

6. Main steps

This guide proposes a step-by-step methodology to support IZ managers in analysing climate risks and developing an adaptation strategy. The approach proposed in this section is composed of 7 steps that are grouped into 3 major phases:

- **The preliminary phase:** This is the preparatory phase of the process, where the objectives, the framework and timetable for the analysis is set.
- **The analysis phase:** In this phase, the vulnerability of the industrial zone to climate change is analysed in order to identify the priority areas of the adaptation strategy. The result of this phase is an adaptation plan that includes a list of adaptation measures that have been approved in a participatory manner.
- **The implementation phase:** This involves defining a strategy to implement the adaptation plan¹³ defined above and setting up a monitoring system to ensure the successful implementation of adaptation measures.



The objective is to provide IZ managers with a basic methodology and general guidelines for conducting such a process within an area. It is a practical and participatory approach to identifying the priorities for an adaptation strategy. IZ managers, their partners or consultants (who may be assisting industrial areas in developing an ACC strategy) can use the proposed approach and tools. Depending on the resources and time available, the format and methodology used for each step may vary. Based on the experience of the PSACC project, we propose the following three options to carry out the analysis phase:

¹³ The adaptation plan is the document that gathers all the measures that have been identified and decided during the analysis process. The strategy sets out the objectives and roadmap for the implementation of the measures decided.

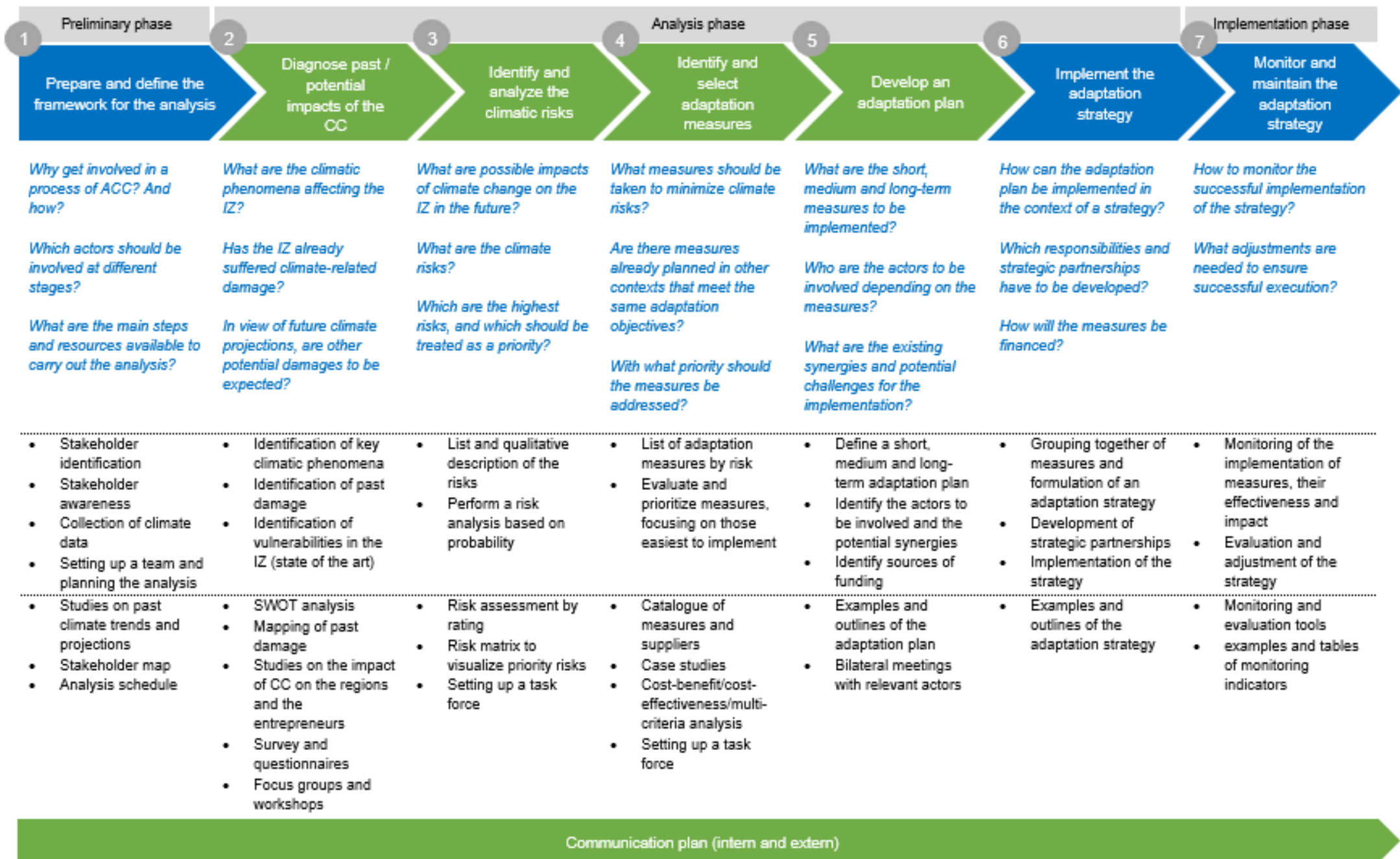
Table 9: Possible scenarios for developing an adaptation strategy

Different options available to apply the proposed methodology	
<p>Option 1 General analysis (no re-sources available for analysis)</p>	<p>Process led and coordinated mainly by IZ managers or one of its close partners</p> <p>Plan two workshops for step 3 "diagnosis" and step 5 "adaptation plan" and carry out the other steps internally, based on the contributions of the partners</p>
<p>Option 2 Detailed analysis (limited resources for analysis)</p>	<p>Process coordinated by the IZ managers supported on an ad hoc basis by a consultant</p> <p>Plan a series of workshops/meetings throughout the analysis and awareness phase, as well as the creation of Task Forces (or Working Groups) for steps 3 "risks" and 4 "measures"</p>
<p>Option 3 In-depth analysis (re-sources available for analysis)</p>	<p>Process coordinated by the IZ managers and supported throughout the analysis phase by a consultant</p> <p>Plan a series of workshops throughout the analysis and awareness phase, as well as the creation of task forces (or working groups) for steps 3 "risks" and 4 "measures". Complete the exercise with more in-depth research and analysis according to your priorities. In this case, it would be recommended to invest in a cost-benefit analysis for the selection of measures.</p>

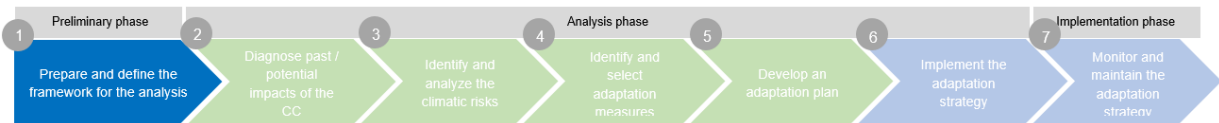
This methodology was developed in a participatory way on the basis of the experiences of the PSACC project in the Ait Melloul Industrial Zone and the contribution of the partners and stakeholders of this zone. Many workshops and on-site evaluation visits have made it possible to develop this practical approach.

An overview of the methodology is presented in the following table. Tools and recommendations for each step are then provided in the form of a step-by-step sheet, as well as practical examples of the climate risk analysis carried out in the pilot area.

Note that the appendices mentioned in this step by step guide are currently only available in French but can be translated on demand. Contact GIZ using the contact details on the Climate Expert website to discuss.



6.1 The preliminary phase



Step 1	Prepare and define the framework for the analysis
Key questions	<p>Why engage in a process of adaptation to CC? And how?</p> <p>Which actors should be involved in the analysis and implementation phase?</p> <p>What are the main steps and resources available to carry out the analysis?</p>
Description	<p>There are several preparatory steps to consider for an effective adaptation process.</p> <ul style="list-style-type: none"> • Define the objectives and scope of the analysis <p>The adaptation process is an exercise that requires the commitment and contribution of a variety of actors and a number of resources. Knowing how to explain the reasons why the IZ must engage in an effective climate change adaptation strategy process is necessary to get it accepted by stakeholders. The decision to develop an adaptation strategy must be taken jointly with key decision-makers in the IZ. Clear and precise objectives must be defined, as well as the scope of the analysis according to the financial and human resources available.</p> <ul style="list-style-type: none"> • Map of the actors <p>An industrial zone is a complex and multidimensional project involving a multitude of actors from the public and private sector as well as civil society. The elaboration of a stakeholder map is an essential step in the preparation of the adaptation process. The challenge is to understand the upstream governance system and identify the key decision-makers, and then to be able to identify the actors to be involved in each the stage of the analysis.</p> <ul style="list-style-type: none"> • Winning the commitment of stakeholders <p>The entire adaptation process, from vulnerability analysis to the selection and prioritization of measures, requires constant dialogue with stakeholders to ensure acceptance of the decisions that will be taken, access to the necessary data for the analysis, and the involvement of decision-makers for the future implementation of the strategy. Raising awareness through seminars or workshops is an essential step.</p> <ul style="list-style-type: none"> • Data collection <p>Climate risk analysis is a complex exercise that requires climate data and projections, as well as information on past impacts and damage already suffered in the area and by companies. Access to and availability of this information is not always easy. Collaborate with information providers. Relying on scientific resources and studies is necessary for a good preparation of the analysis.</p> <ul style="list-style-type: none"> • Plan the analysis and set up a team <p>The analysis phase can be a long process and requires adequate financial and human resources. This is why it is necessary to define the priorities, the timetable and to plan the contributions of the actors according to the different stages of the analysis. It is also advisable to involve an expert who will be in</p>

Description	<p>charge of planning and carrying out the analysis in consultation with the IZ managers. In addition, it is important to set up a team or committee with partners to monitor and coordinate the process.</p> <ul style="list-style-type: none"> • Prepare a communication plan for the entire process <p>The development of an internal and external communication plan during this preliminary phase is recommended for awareness raising and to ensure that the progress and results of the analysis are well disseminated to partners and decision-makers. In this communication plan, it is important to define key and targeted messages according to the type of actors. The language used with public actors will be different from the language used with companies.</p>
Which actors should be involved?	<p>IZ managers and other key partners involved in management. Refer to the map of actors</p>
Tools	<p>Studies on past climate trends and projections. International (UNFCCC), national, local sources. Some organisations develop climate vulnerability studies.</p> <p>Map of actors (example provided in appendix)</p> <p>Timetable for the analysis</p> <p>Communication plan (canvas provided in appendix)</p> <p><i>Climate Expert</i> awareness tools for companies and public-private actors (http://www.climate-expert.org/en/home/tools/toolbox/)</p>
Challenges	<p>Difficulties accessing local climate data</p> <p>General understanding of adaptation and climate risks is weak</p>
Recommendations for action	<p>Have a set of communication and awareness tools at your disposal before starting the process</p> <p>Invest in awareness-raising during the preliminary phase, for example through workshops, before starting the analysis</p> <p>Use clear and simple messages in communicating with stakeholders</p> <p>Gain the support of a partner to support the management structure in coordinating the process</p>

Box 4: Feedback from IZAM experiences: Establishment of an operational project management unit¹⁴ and development of the Stakeholder Map

As part of the management of the PSACC project in the Souss Massa region, an **operational management unit** was created to monitor the process at the IZAM level. As such, **an agreement between the CRI, the OREDD, the Regional Council, the ADIZIA and the GIZ** was signed. The implementation of this multi-stakeholder structure made it possible to develop many synergies to support the implementation of the project, and was essential to support an associative-type management structure such as ADIZIA, which has few resources at its disposal. The major role of this structure has been to raise awareness and analyse risks for IZAM.

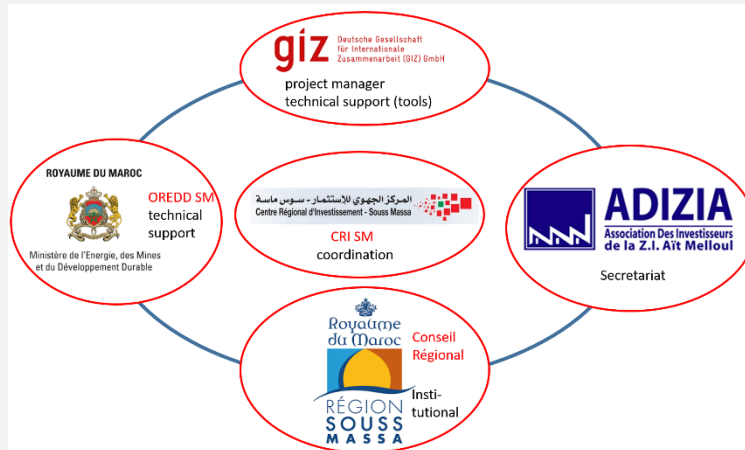


Figure 9: : Steering committee of the PSACC project in the Souss-Massa region

The stakeholder map was produced as part of a working meeting between GIZ and ADIZIA experts. This exercise made it possible to identify the actors who directly or indirectly influence the management of the IZ and to clarify the roles and decision-making powers. For the production of this stakeholder map, the GIZ methodology "Capacity Works"¹⁵ (GIZ Management Model for the management of cooperation systems) was used.

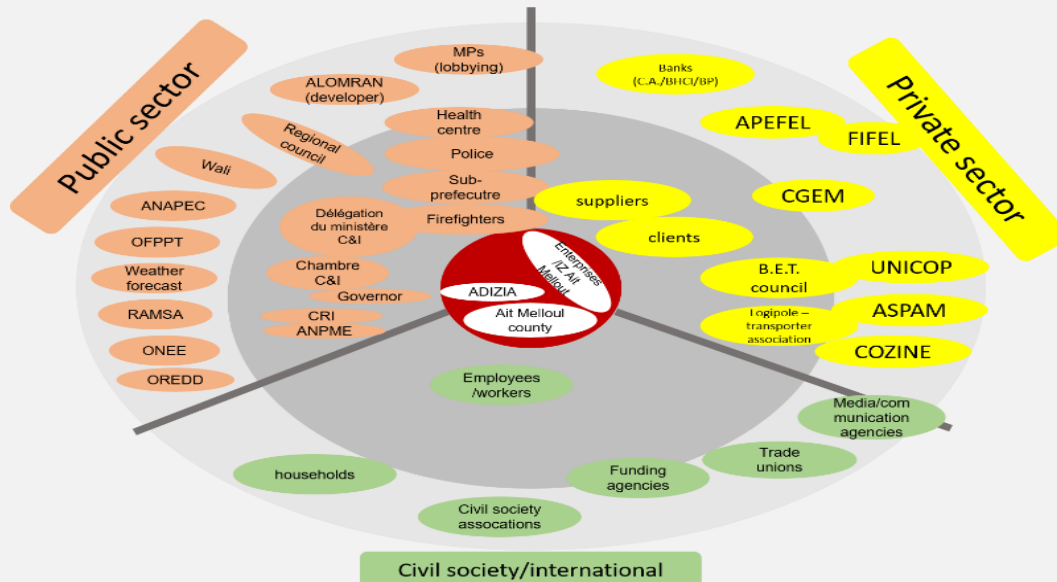
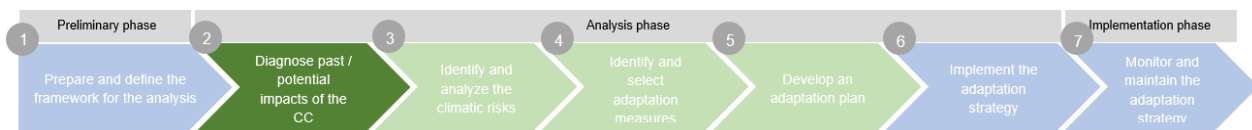


Figure 10: Map of IZAM actors developed by ADIZIA and the PSACC project team

¹⁴ A temporary operational management unit for monitoring the adaptation process in the IMAA was created as part of the PSACC project. This is to be distinguished from the management structure of IZAM, which is represented by the Ait Melloul Investors Association (ADIZIA)

¹⁵ <https://www.giz.de/expertise/html/4619.html>

6.2 The analysis phase



Step 2	Carry out a diagnosis of the past and potential impacts of the CC
<p>Key questions</p>	<p>What are the climate phenomena affecting the IZ? Has the Industrial Zone ever suffered climate-related damage? In view of future climate projections, are other potential damages to be expected? Have any adaptation measures already been put in place or are they planned?</p>
<p>Description</p>	<p>1. Exposure of the IZ to climate phenomena</p> <p>As a first step, it is sufficient to consider the current exposure to weather or climate events, or potential future impacts. Indeed, an IZ that has already been affected by climate phenomena is likely to become even more vulnerable as climate change intensifies.</p> <ul style="list-style-type: none"> • What are the climate phenomena (gradual and extreme) affecting the IZ? (description, history/chronology) • What have been the consequences for the IZ and the companies located there of past extreme events such as floods, heat waves, droughts or storms? • Have there been or can there be any material damage to infrastructure, buildings and companies in the industrial zone? • Have you ever seen disruptions to the operation of the IZ or company processes due to floods, water use restrictions, power cuts, raw material shortages or loss of markets due to a climate phenomenon? • Have you already put in place measures to deal with floods, high heat or water scarcity or are any planned? <p>In this diagnosis, it is important to consider both extreme weather events, namely: storms, heavy rains and floods, heat waves and droughts, as well as gradual climate change phenomena: temperature increases and wide variations, changes in precipitation patterns, sea level rise.</p> <p>There are five impact areas to be distinguished, which affect both the internal functioning of an IZ and its environment and increase the vulnerability of companies. These impact areas are detailed in the appendix. Taking into account the impacts on companies is essential in assessing the vulnerability of an industrial zone.</p> <p>2. State of the art in the IZ</p> <p>To complete the diagnosis, a brief overview of the situation in the IZ is useful to identify potential infrastructural, financial and managerial problems that may increase the area's vulnerability to the CC.</p>
<p>Recommended approach</p>	<ul style="list-style-type: none"> • Start the diagnosis in a workshop with the main partners and operators of the IZ (1/2 to 1 day) • Visit the IZ to observe the elements of the IZ that could increase its vulnerability, e.g. condition of infrastructure, development, etc.

	<ul style="list-style-type: none"> • Survey of companies and operators in the IZ, employees and local residents on their experiences with past climate phenomena (questionnaire and/or interviews)
<p>Which actors should be involved? (refers to the map of actors established during the preliminary phase)</p>	<ul style="list-style-type: none"> • IZ managers & adaptation team • Companies • Climate data providers and climate experts • Planners and operators • Engineers from the local authorities • Residents close to the IZ
<p>What do you need?</p>	<ul style="list-style-type: none"> • Access to relevant climate data for the target group: It is necessary to have climate information on past trends and projections for the coming decades (e.g. for a 10-50 years horizon) • Learn about the damage already suffered and analyse existing risk and vulnerability studies for the region. • Enter a dialogue with stakeholders • Collect all available information on the IZ (e.g. structure, retrofitting plans)
<p>Tools</p>	<ul style="list-style-type: none"> • Technical sheets on impact areas (provided in annex to this guide) • Climate Expert Worksheets (to structure analyses and research) • Mapping of damage caused or potential damage on the basis of an IZ plan • SWOT analysis to assess the strengths and weaknesses of the IZ • Survey and questionnaires to collect information on past damage experienced by companies and common services of the IZ • Focus groups and workshops to collect information on past damage • Studies on the impacts of the CC on regions and industries
<p>Challenges</p>	<ul style="list-style-type: none"> • Difficulties in interpreting climate trends and projections • Access and resources needed to collect information on past damage • Winning the commitment of companies
<p>Recommendations for action</p>	<ul style="list-style-type: none"> • Simplified interpretation of climate trends and projections • Collection of information on past damage • Winning the commitment of companies

Box 5: Feedback IZAM: Workshop on the past impacts of climate change

A half-day workshop, bringing together companies, climate experts, the ADIZIA managers and representatives of local authorities, was organised to collect information on the damage experienced by companies and the industrial zone as a result of climate change. The workshop methodology followed 3 steps:

- First: The climate phenomena affecting the Souss Massa region and the IZ, since the creation of the IZ in the early 1990s, were listed and described.
- Secondly: Each climate phenomenon was studied in order to identify the consequences and possible damages that had already been suffered at the level of the IZ, and within companies.
- Thirdly: The consequences/damages or opportunities were identified and classified by category.

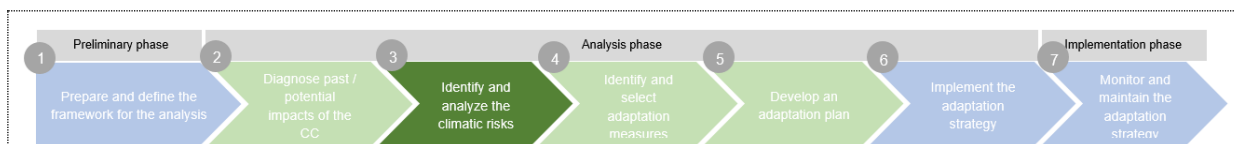
The results of this workshop provided the basis for the diagnosis of the climate impacts of the IZAM.

The contribution of companies was essential to gather as much information as possible. Starting this diagnosis with a workshop, where the concrete experiences of the companies and the IZ management could be exhaustively identified, proved to be an ideal format to define the main lines of the diagnosis and identify the additional analysis needs.

This diagnosis was then completed by a survey of companies in the IZ, bilateral interviews with the Commune, ONEE, RAMSA and ABH, as well as additional information provided by partners (e.g. vulnerability of the Souss Massa region, state of water resources in the Souss Massa region, state of infrastructure, power cuts, changes in the water table level, etc.)



Photo: GIZ - IZAM Vulnerability Analysis Workshop - PSACC Project



Step 3 Identify and analyse climate risks

Key questions
What are the climate risks?
Which are the highest risks, and which should be treated as a priority?

Description
 The second step is to identify all climate risks, then assess and prioritize them. This key step will help to define the priorities for action for the adaptation strategy.

1. Identify risks

Following the previous diagnosis, a more complete and precise method consists in identifying climate risks and describing their effects. The aim is to obtain a mapping of the risks that climate change poses to the IZ and to better understand their consequences.

As illustrated by the table of impact areas, these risks can be of different natures:

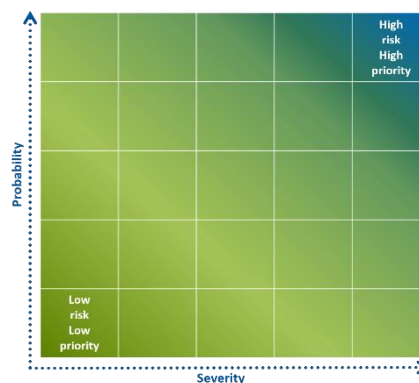
- Site and use of space
- Infrastructure and services
- Companies
- Employees and surrounding populations
- Finance, markets and regulations

2. Assess risks and define priorities for action

A simple method for analysing risks is to conduct a quantified assessment: the risks identified in the previous step are rated according to the following two criteria:

- **The probability of occurrence** of the risk
- **The severity** of the risk, i.e. its likely impact if it occurs

It is the combination of probability of occurrence and severity that determines the risk and allows them to be prioritized. The assessment of the probability of occurrence should take into account future climate projections where they exist, rather than historical data. The severity and probability criteria are scored (scale from 1 to 5). The risk rating is then obtained by **multiplying the probability and severity scores**.



Source: UKCIP 2003

The results can then be visualised in a "**risk matrix**", a tool to facilitate risk interpretation. Once this work is done, the company has a list of the risks most likely to impact its business and will be able to take measures to adapt to them.

Recommended approach	<ul style="list-style-type: none"> • The creation of a specific working group to carry out the risk assessment is recommended. Depending on the complexity of risk mapping, thematic sub-working groups should be created, by risk area. • Data collection and analysis in the background, done by experts, is useful to support the actors in their interpretation.
Which actors should be involved?	<ul style="list-style-type: none"> • IZ managers and adaptation team • Companies • Climate experts • Planner and operators • Local authority engineers
What do you need?	<ul style="list-style-type: none"> • Access to climate data: It is necessary to have climate information on past trends and projections for the coming decades (e. g. 10-50 year horizon) • Technical support required to conduct the risk assessment. • Dialogue with stakeholders to collect information on past damage and events
Tools	<ul style="list-style-type: none"> • Conventional risk assessment tool • Risk matrix to visualize the results of the analysis • Climate Expert worksheets (to structure analyses and research) • Risk mapping (based on an IZ plan/scheme)
Challenges	<ul style="list-style-type: none"> • Divergent interpretations of probability and severity • Lack of data • Uncertainty of climate projections
Recommendations for action	<ul style="list-style-type: none"> • <i>Be careful not to confuse "impacts" or damage caused in the past with "risk"</i>. Risk is defined in relation to the probability of occurrence. It is important to clarify these notions/concepts at the beginning of any meeting or workshop. • Use "reliable" data for evaluation to ensure that prioritisation is relevant • One or more experts to join the working group (or "task force")

Box 6: IZAM feedback: Setting up a specific working group for risk analysis

In the context of the IZAM climate risk analysis, a working group has been set up to assess the risks according to the methodology proposed above. Thematic subgroups were set up to carry out this assessment.

Working group or task force "Risk Analysis".

Site & Infrastructure Theme	Theme Companies & Employees/Populations	Environmental Management and Market Theme
Company of the IZ	RAMSA	ADIZIA
Inzegane Prefecture Ait Melloul	Morocco Weather	Inzegane Prefecture Ait Melloul
OREDD	CRI-SMD	GIZ/ACCN
ABH SMD	Chamber of Commerce and Industry SMD	IZ companies
Municipality Ait Melloul	IZ companies	

Although the representation of citizens (residents) and employees was not possible in this pilot exercise, the SIA approaches and standards used/encouraged to be used at the international level emphasize the important role of these two components.

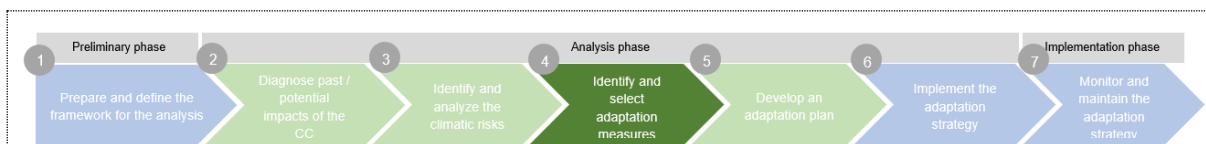
A simple risk assessment method was applied: the rating system presented below where risks are rated according to the two criteria of "probability and severity". Each working group performed the scoring and then an average of the scores was calculated. The scale used for scoring was 1 to 5:

Probability		Impact	
1	Consequences/damages unlikely to occur in the future or never encountered, no immediate impacts	1	No or few consequences/damages
3	Possible consequences/damages in the future, already encountered and likely to occur in 1-2 years, almost immediate impacts	3	Irreversible consequences/damage, disrupting the activity of the IZ
5	Very likely consequences/damages, already encountered and likely to occur within 1 to 2 years, direct and immediate impacts	5	Irreversible consequences/damage, endangering the sustainability of certain installations/activities

An overview of the table used for this evaluation is provided below:

Categories of impact	Risks	Impact	Probability	Risks (impact * probability)	Priorisation	Comments
		estimated total	estimated total	Total	Risk A : >13 Risk B : 7-13 Risk C : 1-6	

The risk assessment ranked the risks according to their level of importance. Three priority risks were identified: 1) floods, 2) water management, and 3) stricter regulation.



Step 4	Identify and select adaptation measures								
Key questions	<p>What measures should be taken to minimize climate risks?</p> <p>Which measures are the most appropriate, in terms of efficiency and cost?</p> <p>Are there measures already planned in other contexts that meet the same objectives as adaptation?</p> <p>How to prioritise the measures?</p>								
Description	<p>In a third step, it is necessary to identify the measures for the various risks identified. Depending on the resources available to carry out the analysis, the first step should be to focus on the priority risks (risk matrix). Following this inventory of adaptation options, an assessment of the costs and benefits of the measures will make it possible to select the priorities to be implemented.</p> <p>1. Identify adaptation measures</p> <p>There are three categories of measures: "grey" measures (infrastructure), "green" measures (ecosystem-based measures), and "soft" measures (organizational). As an industrial zone is a space offering many synergies, it is important to consider individual and collective solutions at different levels, with IZ actors on the one hand, and companies on the other. In addition, it is important not to neglect "soft" solutions, which, through organisational or managerial changes, will make it possible to strengthen the capacity of the IZ to adapt in the long term.</p> <p>2. Select adaptation measures</p> <p>The choice of the assessment method for the adaptation measures depends on the means and data available to perform the analysis. There are 3 different methods for selecting adaptation measures:</p> <table border="1" data-bbox="603 1424 1394 1805"> <thead> <tr> <th>Methodology</th> <th>Prerequisites</th> </tr> </thead> <tbody> <tr> <td>Cost-benefit analysis (CBA)</td> <td>Applied when costs <u>and</u> benefits can be quantified in monetary terms</td> </tr> <tr> <td>Cost-effectiveness analysis (CEA)</td> <td>Applied when costs can be quantified in monetary terms, while benefits are quantified in non-monetary terms</td> </tr> <tr> <td>Multicriteria analysis</td> <td>Applied on the basis of a list of criteria agreed between stakeholders</td> </tr> </tbody> </table> <p>Depending on the method selected, relevant data must be collected to conduct the analysis. In addition to feasibility and efficiency criteria, it is recommended to take into account possible synergies with other projects, as well as local economic and in-</p>	Methodology	Prerequisites	Cost-benefit analysis (CBA)	Applied when costs <u>and</u> benefits can be quantified in monetary terms	Cost-effectiveness analysis (CEA)	Applied when costs can be quantified in monetary terms, while benefits are quantified in non-monetary terms	Multicriteria analysis	Applied on the basis of a list of criteria agreed between stakeholders
Methodology	Prerequisites								
Cost-benefit analysis (CBA)	Applied when costs <u>and</u> benefits can be quantified in monetary terms								
Cost-effectiveness analysis (CEA)	Applied when costs can be quantified in monetary terms, while benefits are quantified in non-monetary terms								
Multicriteria analysis	Applied on the basis of a list of criteria agreed between stakeholders								

	<p>dustrial development priorities. These aspects are particularly important in the context of industrial zones, where private and public interests are interlinked.</p> <p>This selection of priority measures will lay the foundation for the adaptation plan.</p>
Recommended approach	<ul style="list-style-type: none"> • The creation of a specific working group is recommended to identify and select adaptation measures. This working group can be divided up according to the measures in question. • Connect with groups of experts, engineers to find appropriate solutions and techniques
Which actors should be involved?	<ul style="list-style-type: none"> • Management structure & team adaptation • Companies • Technical experts / technology providers • Developers/planners and operators • Engineers and decision-makers from local authorities • Other potential funding agencies
What do you need?	<ul style="list-style-type: none"> • Technical support required for the analysis of measurements • List of urban/local development projects that meet the defined adaptation objectives
Tools	<p>Catalogue of measures for IZ and companies (provided in appendix)</p> <p>Measurement evaluation tools:</p> <ul style="list-style-type: none"> • The guide "Assessment and prioritisation of climate adaptation measures. Guide to decision support in urban climate adaptation" (developed by the Helmholtz Zentrum für Umweltforschung – UFZ (<i>Helmholtz centre for Environmental Research</i>) for the German Federal Ministry for Transport, Construction and Urban Development in 2013 • PRIMATE software – a participatory and multi-criteria tool • GIZ guide "Economic approaches for assessing adaptation options under uncertainty" - 2013 • Guides and templates for CBA and AMC on the GIZ "Adaptation Community" website https://gc21.giz.de/ibt/var/app/wp342deP/1443/index.php/knowledge/mainstreaming/tools/ • Climate Expert Worksheets (to structure analyses and research)
Challenges	<ul style="list-style-type: none"> • Lack of knowledge of the different technical solutions • Lack of information and resources to carry out a CBA • Loss of motivation of some actors
Recommendations	<ul style="list-style-type: none"> • Keep the commitment of the actors for a process that may seem long • Involve experts in the identification of measures <p>One or more experts to join the working group (or "task force")</p>

Box 7: Feedback from IZAM experiences: Workshop on the identification of adaptation measures and establishment of a specific working group to evaluate the measures

The identification of adaptation measures was carried out in the framework of a workshop bringing together companies, the municipality, ONEE, RAMSA, ABH, OREDD and technical experts. The workshop was divided into three thematic working groups, representing the three priority risks identified. A series of adaptation measures were proposed, as well as the actors to be involved depending on the measures.



Photo: GIZ, IZAM Vulnerability Analysis Workshop - PSACC Project

Figure 11: Illustrations of group work from a workshop on the identification of adaptation measures

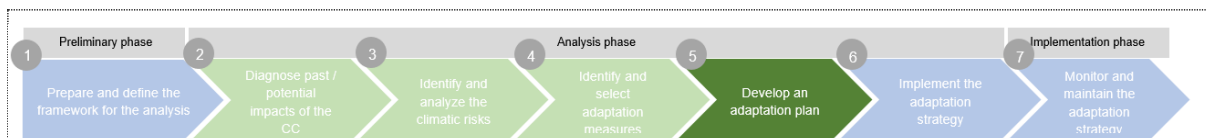
The results of the workshop were then discussed in more detail in a working group or task force on "adaptation measures" that was set up specifically for this purpose. The mission of this working group was to review, validate and evaluate the proposed measures during the measurement identification workshop.

The measures were evaluated on the basis of a multi-criteria analysis based on the following 4 criteria: (1) effectiveness of the measure, (2) technical and organisational feasibility, (3) financial feasibility, (4) negative side effects.

Description of the measures	Effectiveness of the measure	Technical and organisational feasibility x 2	Evaluation criteria			Total	Priority	Comments
			Financial feasibility	Negative side effects				
Awareness and training on environmental regulation and audit and energy efficiency	4	4	4	5	21	P1	Plan training on audit and energy efficiency	
Launch of a programme to support companies in the Ait Melloul industrial estate in regulatory compliance (at regional level)	4	3	3	5	18	P2	--	
Establishment of a monitoring system for environmental regulations and public support programmes	3	3	4	5	18	P2	--	

Figure 12: Table of analysis and evaluation of the measures used by the "Measures" task force

The work carried out by the "Adaptation Measures" working group provided the basis for the adaptation plan for IZAM.

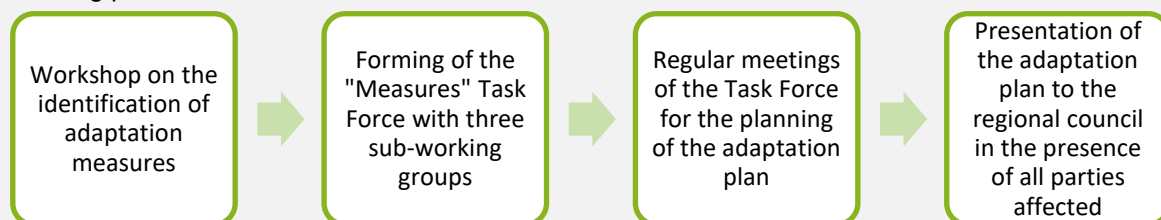


Step 5	
Develop an adaptation plan	
Key questions	<p>What are the short, medium and long-term measures to be implemented?</p> <p>What interactions and synergies with other actors and ongoing projects are relevant?</p> <p>What are the funding opportunities?</p>
Description	<p>The objective of this last step of the analysis is to define the measures to be implemented in the short, medium and long term and to define an action plan for their implementation. This key step must be done in consultation with the various decision-makers (stakeholder map). In defining the plan, a multitude of factors must be taken into account. Two key criteria for defining the most appropriate measures at a given time are the "urgency to manage the risk" and the "costs" of the measure in question. As with any investment decision, the benefits of each measure must be precisely analysed. Public interest criteria and the strengthening of business competitiveness are key factors.</p> <p>Other general recommendations for the definition of the plan include:</p> <ul style="list-style-type: none"> • Integrate adaptation actions into a framework in accordance with existing management systems (strategy, policy, standards), validated by all partners • Indicate which interactions are relevant for which other actors and their contributions • Clearly identify the roles and responsibilities of each stakeholder, as well as a schedule of activities • Identify opportunities that can be exploited by integrating climate change adaptation into other activities or projects • Indicate the resources (staff, capital) that will be required to implement these measures and monitor their effectiveness • Identify potential obstacles to the implementation of actions and mechanisms to overcome them. <p>The climate change adaptation plan must be integrated into the usual organisational processes of an IZ. Its implementation will be strongly influenced by local policies and the type of management of the area.</p>
Recommended approach	<ul style="list-style-type: none"> • Before defining the adaptation strategy, it is advisable to meet with the decision-makers who will be involved in investment decisions, in order to raise their awareness upstream and explore opportunities for collaboration.

Which actors should be involved?	<ul style="list-style-type: none"> • IZ managers • Working group • Decision-makers • Potential public and private funders involved in the sector
What do you need?	<ul style="list-style-type: none"> • Dialogue with stakeholders to ensure acceptance of the adopted measures
Tools	<ul style="list-style-type: none"> • Outline of adaptation plans (provided in appendix) • <i>Climate Expert Worksheets</i>
Challenges	<ul style="list-style-type: none"> • Loss of motivation of the actors • Lack of information and technical expertise on some measurement issues • Difficulty in making financial estimates at this stage • Ability of management structures to manage the process as a whole
Recommendations for action	<ul style="list-style-type: none"> • Communicate this adaptation plan to ensure the support of potential strategic partners in the implementation • Integrate the process into the frameworks in place or envisaged by the IZ management (sustainable development strategy, Environmental and Social Management Plan)

Box 8: IZAM feedback: Development of the adaptation plan

The IZAM adaptation plan was developed in consultation with all stakeholders and according to the following processes:

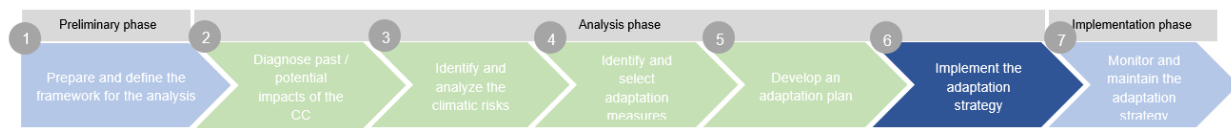


The process began with a workshop during which the results of the risk analysis were presented to all relevant stakeholders. During this workshop a collective reflection on ACC measures was initiated and a specific "Measures" Task Force was created to validate the measures and develop the ACC plan.

This task force was composed of three sub-working groups equivalent to the three priority risks identified. It was made up of actors directly linked to the risks identified. The Task Force was coordinated by the Inzegane Ait Melloul Provincial Council, and each of the three sub-groups was led by the actor most concerned with the priority risk identified. The Task Force worked autonomously for about three months to define an adaptation plan.

The results of the Task Force's work were presented to the Regional Council in the presence of all stakeholders (project partners, administrations and services members of the "Risks" and "Measures" Task Forces) in order to validate the adaptation plan and define the modalities for its implementation by each of the actors concerned. The objective of this final feedback meeting was to study the opportunities for integrating the adaptation plan into the region's development plans and actions.

6.3 The implementation phase



Step 6	Implement the adaptation strategy
Key questions	<p>How can the adaptation plan be implemented in the context of a strategy?</p> <p>What are the responsibilities and strategic partnerships to be developed?</p> <p>How will the measures be financed?</p>
Description & recommended approach	<p>The strategy for ACC does not differ from other processes in the IZ. It can be integrated and managed in the same way, and its implementation will be strongly influenced by the management structure of the IZ, its organization and local development policies and projects.</p> <ol style="list-style-type: none"> <p>1. Develop a strategy</p> <p>First, it is a question of defining the implementation or operationalisation of the validated adaptation plan as part of a coherent strategy integrated into the activities or projects of the IZ. In formulating this strategy, it is important to define SMART objectives (Specific, Measurable, Achievable, Realistic, Time-bound), determine roles and responsibilities by measure, and plan in detail the process and timetable for implementing the measures. The identification of leaders responsible for the implementation and monitoring of the various measures will be useful to support the IT managers in this process. To ensure effective implementation, it is also necessary to identify mechanisms to assess the performance of the strategy and the adopted measures.</p> <p>2. Develop strategic partnerships</p> <p>The development of strategic partnerships for the implementation of adaptation measures is a priority step. Through these partnerships, IZ managers can obtain the support of public authorities, donors, and other organizations for their adaptation efforts, whether through financial or technical support. The mobilization of partners is a process that should take place in parallel with the analysis phase, as efforts to raise awareness and mobilize stakeholders can be important. In addition, it is important to formalize these partnerships within the framework of agreements that define the objectives and responsibilities for each stakeholder.</p> <p>3. Financing the measures</p> <p>On the basis of the initial research and exchanges with the actors involved, funding opportunities can be identified. These are at different levels (international, national, regional and local) and will vary according to the type of measures. The objective is not to find a single funding for the entire adaptation plan. Due to the multidisciplinary nature of adaptation, it is advised to combine different sources of financing and to integrate certain measures into the retrofitting or local development plans planned for the area. Industrial zones do not have to bear all the costs of adaptation alone: to achieve long-term sustainable solutions, local authorities and companies in the area must contribute to these adaptation efforts. For more information on financing options, see the box below.</p> <p>4. Strengthen its service offer</p> <p>In order to put in place sustainable solutions for the resilience of industrial areas, adaptation efforts must take place primarily at the enterprise level. IZ managers can play a leading role in supporting companies in this process.</p>

	<p>Through the provision of adaptation services, they can thus strengthen their service offer to companies and increase their image as a sustainable industrial zone. The types of services that IZ managers can offer to companies in the area of adaptation may include:</p> <ul style="list-style-type: none"> ▪ Training, information and awareness sessions ▪ Access to climate data, tools and information on available financial and Technical support ▪ Access to a network of experts ▪ Support on a risk analysis. <p>These services can be integrated into the existing service portfolio of the IZ management. The appendix provides an example of a service offer using the example of the Ait Melloul industrial estate. The presentation of this new service offer will have to be accompanied by new communication activities.</p>
<p>Which actors should be involved?</p>	<ul style="list-style-type: none"> • IZ managers • Small working group • Decision-makers • Public funds, commercial banks • Other organizations according to the themes of adaptation measures
<p>What do you need?</p>	<ul style="list-style-type: none"> • Awareness raising among the actors involved • Networking to develop the necessary partnerships • Overview of funding opportunities • Identification of leaders and/or organisations responsible for the implementation of the measures
<p>Tools</p>	<ul style="list-style-type: none"> • A strategic document that integrates the adaptation plan and a timetable for the implementation of the measures • Service offer presentation document (i.e. a communication document that presents the services or activities that the IZ offers to its companies)

Box 9: Financing adaptation - What are the financing options for the adaptation of industrial zones?

For industrial areas, funding for adaptation is primarily provided by public funds. See below an overview of the funds or actors involved in financing infrastructure projects in Moroccan industrial zones.¹⁶

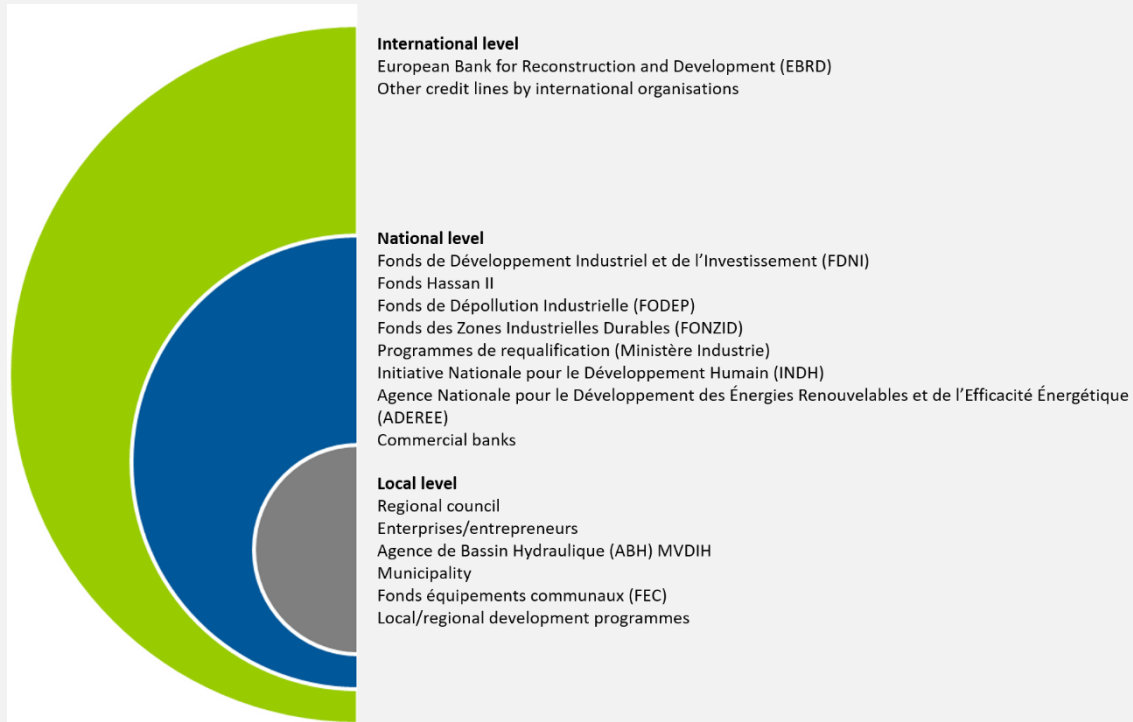


Figure 13: Overview of funds or actors for ACC funding in IZs

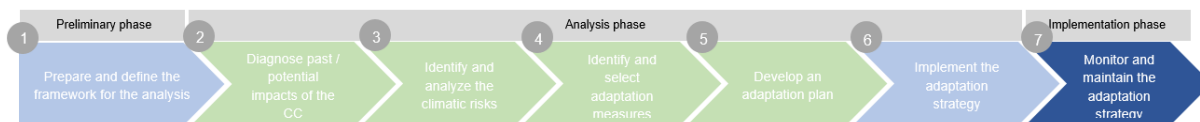
Through the **Green Climate Fund**, an international fund to finance low-carbon and/or resilient development measures in response to the CC, new funding will be available. In Morocco it is managed by the Agence pour le Développement Agricole (ADA), an accredited national agency among other organizations.

In addition to public funds, it is recommended to explore the possibilities of co-financing by businesses for the implementation of communal measures at the level of the industrial zone.

At the company level, there are not yet any financial instruments specific to ACC. However, companies can access the various public support programmes in the energy and water sector, or specific credit lines for financing sustainable energy (e.g. MORSEFF, FODEP, MEDREP/Promasol, Prosol, FEMIP, FCCM etc.). These funds are available through commercial banks. Under the European Bank for Reconstruction and Development (EBRD) *Small Business Support* Programme, companies can also apply for funding for ACC measures.

For more information on the funding options listed above, please consult the resources and useful links in the "Support, tools and resources" section.

¹⁶ Conclusions of the proposals made by the participants of the COZINE training workshop "Adaptation for Industrial Zones" on the theme of financing adaptation.



Step 7	Monitor and maintain the adaptation strategy
Objective	<p>How to monitor the successful implementation of the strategy?</p> <p>What adjustments are needed to ensure successful execution?</p>
Description & recommended approach	<p>Once the strategy is developed and adaptation measures are planned, its proper implementation must be monitored, and the achievement of its objectives must be evaluated. It is a continuous process of monitoring the performance and the impact of actions. The adaptation process does not stop once the first steps are taken. The objective is to ensure that climate risks are controlled. Continuous monitoring and evaluation is essential to ensure that the risk is under constant control, and that the industrial zone and companies are gradually adapting. It is also a process of continuous improvement. The strategy may be adjusted in the light of feedback and changes in the political, economic and environmental context. It is advisable to set up monitoring mechanisms (or integrate them with existing mechanisms), and to review the adaptation strategy at least every two years.</p> <p>As part of the monitoring of the strategy, the following points should be considered:</p> <ul style="list-style-type: none"> ▪ Monitor the implementation of the measures: Have the adaptation measures achieved their objectives? Have the risks been reduced? Are implementation costs minimized? For each measure it is necessary to analyse the measures according to their effectiveness, efficiency and relevance, as well as their contribution to the sustainability objectives of the IZ. ▪ Monitor the evolution of the vulnerability of the IZ: How many companies were affected following the last extreme weather event? In addition to assessing adaptation measures, it is important to develop indicators that will make it possible to monitor the vulnerability of the industrial zone and to monitor climate projections in order to anticipate potential new risks. In this context, it is also important to make an inventory of weather events and damage to the area or companies. ▪ Define monitoring indicators: It is recommended to define precise and measurable indicators to assess the performance of the measures and the changes to the vulnerability of the IZ and its companies. ▪ Communicating the results of the adaptation strategy: regular communication with partners, regarding key indicators, will help to maintain their interest and commitment.
Which actors should be involved?	<ul style="list-style-type: none"> ▪ IZ managers ▪ Lead partners/organisations responsible for the implementation of measures
What do you need?	<ul style="list-style-type: none"> ▪ Identify a person responsible for this follow-up ▪ Inform the leaders on the monitoring mechanism in order to ensure their contribution
Tools	<ul style="list-style-type: none"> ▪ Monitoring and evaluation tools ▪ List of examples of monitoring indicators

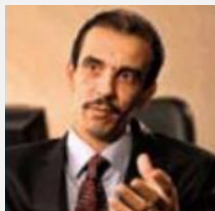
Section C: Strengthening the adaptability of industrial zones and companies: Recommendations



Photo: GLZ

The next section examines in more detail how Adaptation to Climate Change can be incorporated in industries and industrial areas in a sustainable way. It presents recommendations on the **support factors and actions needed to support IZs and management structures in their adaptation efforts.**

- How to strengthen the adaptation capacity of IZs?
- What technical, financial and political support is needed to help IZs in their adaptation process?



"The company is a taxpayer, a creator of wealth, a creator of employment. Today, our role is not only to attract new investors and accelerate business creation procedures, but above all to preserve existing investments. (...) Today we must put in place support mechanisms for procedures and new standards for industrial zones to make adaptation to CC an essential component in our development, encourage not only companies to put themselves in this perspective but also scientific research adapted to the company's needs. »

(Quote translated for this guide)

Khalil Nazih, Director of the Souss Massa Regional Investment Centre

7. Challenges to adapting industrial zones

Despite the need for action to adapt to climate change, very few industrial zones have now integrated climate risk management into their operational plans. Amongst the obstacles are:

- **It is a new topic for industrial zones and companies:** Adaptation is often still seen as a topic for the public domain and many companies are not aware of the risks and opportunities posed by CC. However, industrial zones must consider all the risks to which companies are exposed

to (e.g. supply chain, damage to the production apparatus). Companies and thus their competitiveness are already affected. IZ managers are also the ones able to offer the services necessary to help SMEs adapt.

- **A new approach to sustainability:** Stakeholders in industrial zones and companies have so far approached the topic of environment in terms of the impact of businesses on the environment and the application of new environmental regulations. The reflection on adaptation raises the opposite question: how will IZ services and corporate activities be affected by climate change? This approach to environmental issues is still new. However, there are many links between measures to reduce the climate impact of companies (CC mitigation) and adaptation measures.
- **Lack of capacity of IZ managers:** The majority of industrial areas in Morocco are old-generation areas, with little or no management structure in place. Management structures, particularly those of associations, often do not have the human and financial resources to initiate an adaptation process. They often face the problem of non-payment of contributions by companies and do not receive support from public authorities. In addition, they often lack organizational capacity.
- **A multitude of actors involved in the management of industrial zones:** An industrial zone is a complex system where a multitude of public and private actors interact. This situation is all the more complicated in the context of associative management of IZs: there are many more partners involved in the management (commune, business association, etc.), which can complicate the decision-making process. This complexity can be a barrier to implementing the adaptation process, or will require more resources. Our exchanges with private management structures showed that the adaptation process would be more easily managed under private management than under association-based management, which has fewer resources.
- **The belief that adaptation requires very high investments:** While some measures require huge investments, particularly when it comes to major infrastructure projects or the rehabilitation of areas, it is important to remember that adaptation is also a source of cost reduction. Indeed, an early risk management approach will avoid costs related to major climatic events. Some adaptation measures, such as those in the field of sustainable water management, offer real financial gains with relatively short depreciation periods. Finally, it is important to also consider soft or management measures, which have low costs while strengthening adaptability in the long term.
- **The lack of available tools and expertise:** Until now, small and medium-sized enterprises (SMEs) in particular did not have sufficient means, capacity and infrastructure to adapt to CC. In Morocco, as in most countries, there is not yet any support available for this area, and there are few experts or consultants trained to help companies in this process. Industrial zones are confronted with the same situation; few studies or tools specific to industrial zones have been developed. There is a need to disseminate tools on climate risk and opportunity management to SMEs and IZ managers.
- **Access to climate data:** Climate data is not always easily accessible, despite the efforts made through the OREDD network in Morocco. Organizations often do not know where to find the information. In addition, the data available are often very technical and difficult to interpret. It is important to make climate data available to companies and private sector actors in a format that meets their needs.
- **Financing:** several financing opportunities exist for industrial areas in Morocco, but processes can be cumbersome and time-consuming. In addition, there are few financing opportunities available to help SMEs adapt and those that are available are often unknown to SMEs.

8. Our recommendations: How to support management structures in the adaptation process?

In order to strengthen the resilience of industrial zones and of the companies located there, we recommend action at three different levels. The recommendations below are based on the experience of the PSACC project, with the contribution of the partners and actors involved in the pilot phase of the project, as well as that of the COZINE members.

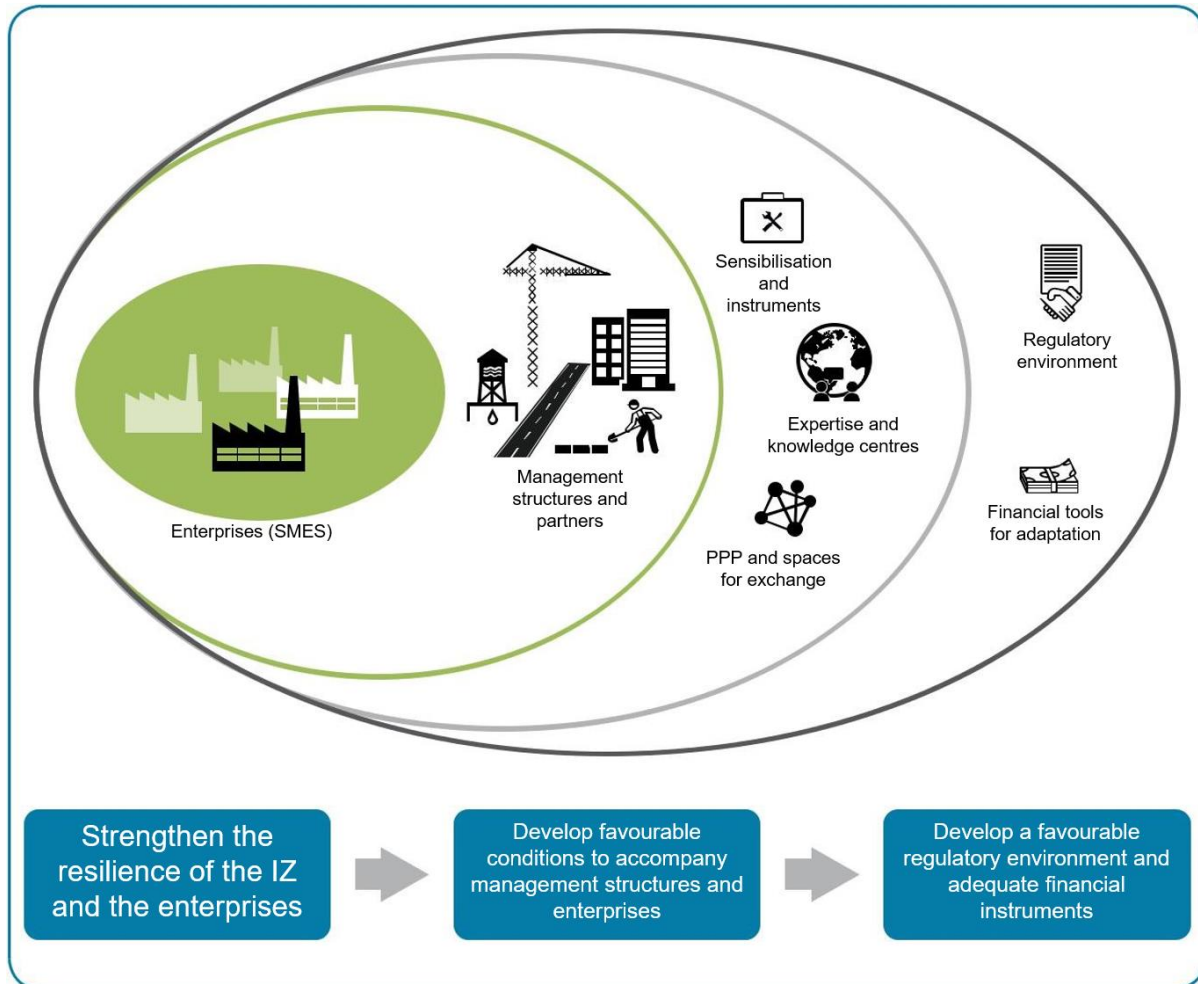


Figure 14: Three levels of intervention to strengthen the resilience of Industrial and Enterprise Zones

First level of intervention: Strengthening the resilience of Industrial Zones and Businesses

- Promote the adaptation of SMEs using Industrial Zones:** For a sustainable adaptation of the private sector, industrial zones represent an ideal space to organize the support of companies in this process. The aim is to strengthen the resilience of both industrial areas - i.e. common services and infrastructures - and companies. To ensure their long-term survival and competitiveness, companies must integrate climate risks into their strategy and management, and implement measures to reduce these risks. However, they cannot act alone. They need a safe external environment and infrastructure that is resilient to heavy rains, heat, etc. In this perspective, it is necessary for industrial areas to undertake adaptation actions in the same way as companies. Moreover, through their multiplier effect on companies and the inter-company synergies they offer, they can play a central role in supporting companies in the development of adaptation strategies.

- **Strengthen the capacities of Industrial Zone managers:** For the adaptation of industrial zones, a strengthening of the capacities of management structures is necessary at **different** levels:
 - **Strengthening the organizational capacities of management structures:** The majority of Moroccan industrial zones are managed by associations. They are often confronted with management and resource problems, and cannot ensure good management or provision of services to companies. A revision of the statutes of the management structure of former industrial areas and support from public authorities in terms of organisational capacity is necessary for IT managers to have the means to adapt.
 - **Strengthen the capacities of management structures to develop adaptation strategies:** Just like companies, management structures need support to initiate an adaptation process. Examples of activities in this field include awareness-raising sessions, training or exchanges of experience and good practices.

- **Supporting companies in their adaptation efforts: a new service offer for management structures:** IZ managers have a central role to play in helping companies adapt, by informing them, raising awareness and providing them with the necessary tools and expertise. To provide this support, it is important to develop partnerships with networks of experts, climate data providers, and providers of technical and financial support. IZ managers can thus strengthen their service offer to companies.

- **Establishment of a good governance system for adaptation at the level of industrial zones:** To develop an adaptation strategy at the level of an industrial zone, it is important to create a good governance structure between public, private and civil society actors. The adaptation of an industrial zone is a complex and multidisciplinary process, which requires the involvement and support of multiple actors, different sectors and at different levels. Creating the right links and communication methods to conduct an adaptation process in a participatory way, and setting up an effective steering structure are success factors.

Second level of intervention: Create favourable conditions to support management structures and companies in the adaptation process

- **Access to climate data:** Promoting access to CC data at the local level is an important step in enabling management structures and companies to develop adaptation strategies. In addition, this information should be disseminated in a format adapted to the needs of companies. Online databases at the national or regional levels can be set up. Through this regional variation of the CC information systems, the information can be easily disseminated to industrial areas throughout a region.

- **Develop tools for operationalizing adaptation to the CC:** New frameworks for sustainable industrial zones, e.g. AIS guidelines or the HQE-Management reference framework, consider adaptation in the different phases of the IZ life cycle. Operationalization tools are now needed to support management structures in the operationalization of the ACC. This guide provides a tool for existing industrial zone management structures to manage climate risk. ICZM is currently working on other instruments (e.g. site selection and selection as part of the planning of new IZs) to complement this approach.

- **Access to a centre of expertise and knowledge:** In order to develop and implement adaptation strategies, companies and IZ managers need technical support to carry out climate risk analyses. There is a need to create local expertise to carry out this type of analysis, which requires climate, management and sectoral knowledge. There is also a need for expertise in the selection and implementation of technical adaptation solutions (e.g. water, energy technologies, etc.). This involves training experts, consultants, and consulting firms in order to create a pool of experts that management structures can use to develop their own strategy and in case of requests from companies in their industrial zone.

- **Technical and financial support to carry out risk analyses:** Adaptation is a new topic for SMEs. Incentives and support are needed to promote this approach. Setting up technical support programmes (e.g. awareness raising, training, tools) as well as financial assistance for risk analysis will encourage companies and support them in their efforts.
- **Set up learning and exchange spaces between Industrial Zones:** The Collective of Industrial Zones for the Environment (COZINE) has been identified as a key player in supporting management structures in their adaptation efforts. It could provide the necessary tools for IZ managers, and could also be used as a platform for exchanges between IZs on the theme of ACC.
- **Awareness-raising among all stakeholders:** The adaptation of industrial zones concerns public policy decisions such as investments in infrastructure as well as private actions. To prepare an adaptation strategy and ensure stakeholder engagement throughout the process, significant efforts must be made to raise awareness. Other key private sector actors such as professional associations, regional investment centres, financial institutions, etc. must be trained in the same way as IZ managers to raise awareness among companies. In addition, strengthening public-private dialogue can also be helpful.

Third level of intervention: Developing a favourable regulatory framework and adequate financial tools

- **Integrate adaptation into the industrial policies and mandates of Industrial Zones:** Adaptation must be integrated into the planning of new industrial zones, and the retrofitting of existing zones. This includes, for example, integrating climate resilience criteria into the selection of new sites, or integrating risk analyses into planning and retrofitting studies. The SIA guidelines as well as the orientation guide for the transition to Sustainable Industrial Zones in Morocco give recommendations and main areas of intervention in this field. At the national level, the National Climate Change Committee (NCC) is a key actor in introducing and promoting the issue of adaptation in industrial zones. At the regional level, the Territorial Plan to Combat Climate Change (TPCC) provides a solid framework for operationalizing the adaptation of industrial zones.
- **Develop appropriate financing for industrial zones and companies:** Today there is a lack of suitable financial products to cover the adaptation needs of SMEs. However, in the international context, new opportunities are emerging with green financing. There is a need to develop solutions and recommendations for interventions to finance companies' adaptation measures. At the level of industrial zones, public or international funds specific to sustainability such as FONZID for the financing of sustainable industrial zones are good examples of financing infrastructure projects.
- **Develop a specific certification for ACC:** By obtaining a specific "certification" for adaptation, IZ managers will be able to strengthen their service offer and image of sustainability. Through the HQE-Aménagement reference system¹⁷, a sustainability certificate is available.

¹⁷ A French certification system for urban planning as well as construction planning and management.

Box 10: The *Climate Expert* – a tool for companies to develop a strategy for adapting to CC

CLIMATE EXPERT

The *Climate Expert* is an approach developed by GIZ with technical support by adelphi to support climate risk and opportunity analyses of small and medium-sized enterprises. The *Climate Expert* follows a clear and modular "step-by-step" method. Each step can be performed independently.

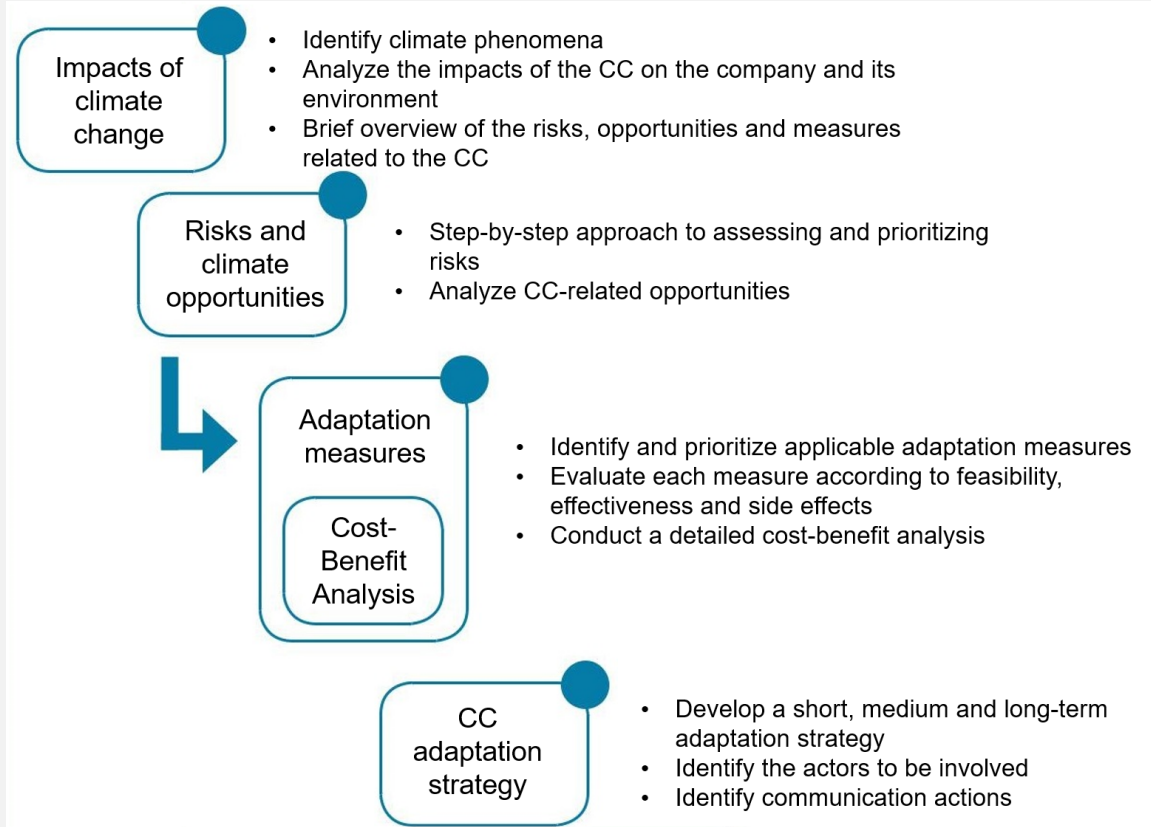


Figure 15: Methodology and steps of the *Climate Expert* for companies

All the documents required for analysis can be viewed or downloaded from www.climate-expert.org.

The main tools are:

- Information on climate change and its challenges in English, French and Spanish
- The detailed ACC method in English
- Analysis matrices and excel worksheets to perform the analysis in English, French and Spanish
- International case studies to practice and understand the proposed method, in English, French and Spanish
- A manual for trainers and enterprise consultants for ACC, in English

Support, tools and resources

Resources on Adaptation to Climate Change in industrial zones and for businesses

Climate change, international resources

- Introduction to the terms of climate change and its adaptation. IPCC: https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-AnnexII_FINAL.pdf
- Publications and reference data on climate change. IPCC: <https://www.ipcc.ch/data/>
- International programmes against climate change. UNEP: <https://www.unenvironment.org/>
- Photos and visual data on climate change around the world. NASA: <http://climate.nasa.gov/>
- Weather information. WMO: <http://worldweather.wmo.int/en/home.html>
- Exposition on the effects of climate change explained with examples: <https://exhibition.ecc-platform.org/>

Climate change in Morocco

- The 2016 Moroccan information on climate change, its impacts on the country and policy responses, in French: http://www.environnement.gov.ma/images//Mde_PDFs/Fr/TCN_web.pdf
- Morocco's political and legislative response to climate change. United Nations Framework Convention on Climate Change, 2016. In French: http://www.environnement.gov.ma/images//Mde_PDFs/Fr/Rapport_BUR.pdf
- Climate projections. Climate Service Center Germany, 2013: <https://www.climate-service-center.de/index.php.en>
- Projections and scenarios of CC in Morocco. World Bank Climate. http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCCode=MAR&ThisTab=ClimateFuture

Resources on adaptation for companies

- Toolbox and necessary information for the adaptation of companies. Climate-expert: <https://www.climate-expert.org/en/home/tools-trainings/introduction-to-tools>
- Site presenting and enabling an exchange on adaptations of successes by enterprises around the world. <http://www.adaptationcommunity.net>
- Updated brochure presenting the challenges of climate change for companies, in English. UKCIP: http://www.ukcip.org.uk/wp-content/PDFs/UKCIP_Business.pdf
- Detailed method and tools to adapt your company, in English. UKCIP: <http://www.ukcip.org.uk/wizard/>
- Community site for sharing knowledge and measures for adaptation on the ACC around the world: <https://www.weadapt.org/>
- Private Sector Participation in Climate Change Adaptation, OECD (2011): https://www.oecd-ilibrary.org/environment/private-sector-engagement-in-adaptation-to-climate-change-approaches-to-managing-climate-risks_5kg221jkf1g7-en

Resources on adaptation for industrial areas

- Presentation of the effects and impacts of the CC on the industrial zones and adaptation measures to the CC and checklist for their adaptation, in German. KLIMAIX: <http://www1.isb.rwth-aachen.de/klimaix/>

- Detailed brochure on the risks and impacts of the CC on industrial zones, in German. KLIMAIX: <http://www1.isb.rwth-aachen.de/klimaix/downloads/KlimaixLeitfadenDownload.pdf>
- Brochure presenting the challenges of the adaptation of industrial zones in India, in English. <https://tsiic.telangana.gov.in/wp-content/uploads/2016/05/3.-CCA-STRATEGY.pdf>

Resources on sustainability in industrial areas

- Orientation guide for the transition to Sustainable Industrial Zones in Morocco. In French. MEMEE and GIZ. https://www.climate-expert.org/fileadmin/user_upload/Guide_transition_ZID_F.pdf
- Manual for the requalification and creation of industrial zones in Tunisia. Ministry of Industry and Tunisian technology and GIZ. 2015. Useful resources for the operationalization of the Site Master Plan, a design tool for a sustainable industrial zone, integrating all major economic, social and environmental aspects. In French. https://www.sia-toolbox.net/file/289/download?token=tQkDg_ER
- General information on standards, support programmes of the Moroccan Ministry of the Environment. In French: <http://environnement.gov.ma/fr/78-cat1/1027-qui-etes-vous-ong-industriels>
- Toolkit for the development of the eco-industry and eco-parks developed by GIZ and its partners, in English. <https://www.sia-toolbox.net/tools/giz-expertise-and-tools>
- Products of the SIA ("Sustainable Industrial Areas") Working Group of the GIZ: <http://star-www.giz.de/starweb/giz/pub/servlet.starweb?path=giz/pub/pfm.web&r=42632>

Resources on accommodation measures

- Adaptation catalogue www.climate-expert.com
- Detailed sheets of rainwater management measures. In French. AGIRE Maroc: <http://www.agire-maroc.org/activites/gestion-des-eaux-pluviales/fiches-des-bonnes-pratiques-de-gestion-des-eaux-pluviales-07-avril-2015.html>
- GIZ/BMZ, Reference Guide on Vulnerability Analysis - Concept and Guidelines for Conducting Standardized Vulnerability Analyses: https://gc21.giz.de/ibt/var/app/wp342deP/1443/wp-content/uploads/filebase/va/vulnerability-guides-manuals-reports/Vulnerability_Sourcebook_-_Guidelines_for_Assessments_-_GIZ_2014.pdf

Case studies

- Case Studies of Adaptation of Small and Medium-Sized Climate-Expert Companies: <http://www.climate-expert.org/en/home/case-studies>
- UNFCCC Private Sector Initiative - Database of adaptation actions: <https://unfccc.int/topics/resilience/resources/psi-database>

Resources on adaptation financing

- UNEP Demystifying Adaptation Finance for the Private Sector: <http://www.climate-expert.org/en/home/finance-adaptation/introduction-to-financing/>
- Green Climate Fund: <http://greenclimate.fund/>

Key actors in Climate Change Adaptation in Morocco

For more information on the Adaptation on Climate Change in Morocco and personalised support, you can visit the websites of the following actors or contact them:

Climate data and vulnerability analyses

- **Ministry delegated to Energy, Mines and Environment of Morocco/ Regional Observatory for Environment and Sustainable Development (OREDD)** (in French or Arabic):
<http://www.environnement.gov.ma/fr/>
- **Morocco Meteo:** <http://www.marocmeteo.ma/>
- **United Nations Development Programme (UNDP Morocco)** (in French):
<http://www.ma.undp.org/>
- **Climate Competence Centre of Morocco:** <http://www.4c.ma/en>

Industrial zones

- **COZINE (Collectif des Zones Industrielles pour l'Environnement):** Organization promoting the eco-responsibility of Moroccan industrial zones. <http://energienvironnement.com/cozine-lecologie-industrielle-developpement-durable/>
- **Ministry of Industry:** <http://www.zonesindustrielles.ma/?lang=en>
- **Regional Investment Centres :** Contacts by region: <http://www.service-public.ma/en/web/guest/home>

Tools, awareness-raising materials and ICZM training

- **GIZ PSACC project:** On the adaptation to private sector climate change, see www.climate-expert.org
- **GIZ-PGPE Programme** (closed in 2015) - material available on the website: <http://www.environnement.gov.ma/fr/>
- **GIZ-ECG Project:** Contact: abdelaziz.mrani@giz.de
- **GIZ Project - AGIRE Maroc :** Support programme to integrated water resources management: <http://www.agire-maroc.org/>
- **GIZ Project - DKTI Morocco:** support programme on renewable energies <https://www.giz.de/en/worldwide/31958.html>
- **GIZ Project - Re Activate:** Sustainable Energy Programme d'appui <https://www.giz.de/en/worldwide/37821.html>
- **GIZ Working Group " Sustainable Industrial Areas":** Contact Morocco: abdelaziz.mrani@giz.de

Experts

- **Climate Expert Network:** Group of experts from the Souss Massa region trained in the Climate Expert methodology. Information on the list of experts trained on the Climate Expert at CCISA
- **Centre de Compétence Climat du Maroc:** Database of climate experts : <http://www.4c.ma/en>
- **Chamber of Commerce, Industry and Services** (in Arabic): <http://www.fcmcis.ma/> and local CCIS

Appendices

The "annexes" mentioned in this guide offer a variety of tools, frameworks and additional information to support management structures in initiating and implementing an adaptation process in their industrial zone. These are currently only available in French but could be translated on demand. Contact GIZ using the contacts on the Climate Expert website to discuss. The Annexes include:

- Fact sheets on impact areas with guided questions and examples for initial diagnosis or risk analysis.
- Example of a service offer
- Additional case studies
- Adaptation plan outline
- Communication plan outline
- Information on the *Climate Expert* for companies and available awareness tools
- Catalogue of adaptation measures for industrial areas
- Information leaflet on funding opportunities for private sector adaptation

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