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ADAPTATION

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ADAPTATION: PUBLIC FINANCIAL INSTITUTIONS (ALSO) HAVE A ROLE TO PLAY – A STUDY BASED ON THE FRENCH EXAMPLE

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This report is an English translation of the results of the Finadapter project supported by ADEME under the ClimFi call for projects. The research questions in this project were based on the French example. This analysis does not claim to provide results that are universal or can be directly transposed to all situations, but rather serves as a contribution to the collective discussion by providing a detailed analysis of a national context and the proposals arising from this particular situation, one with which others may be able to identify.

For more information on the project:
https://www.i4ce.org/go_project/finadapter/

The Institute for Climate Economics *(I4CE)* is a Paris-based think tank with expertise in economics and finance with the mission to support action against climate change. Through its applied research, the Institute contributes to the debate on climate-related policies. It also publishes research to support financial institutions, businesses and territories in the fight against climate change and that assists with the incorporation of climate issues into their activities and operations. I4CE is a registered non-profit organisation, founded by the French National Promotional Bank Caisse des Dépôts and the French Development Agency.

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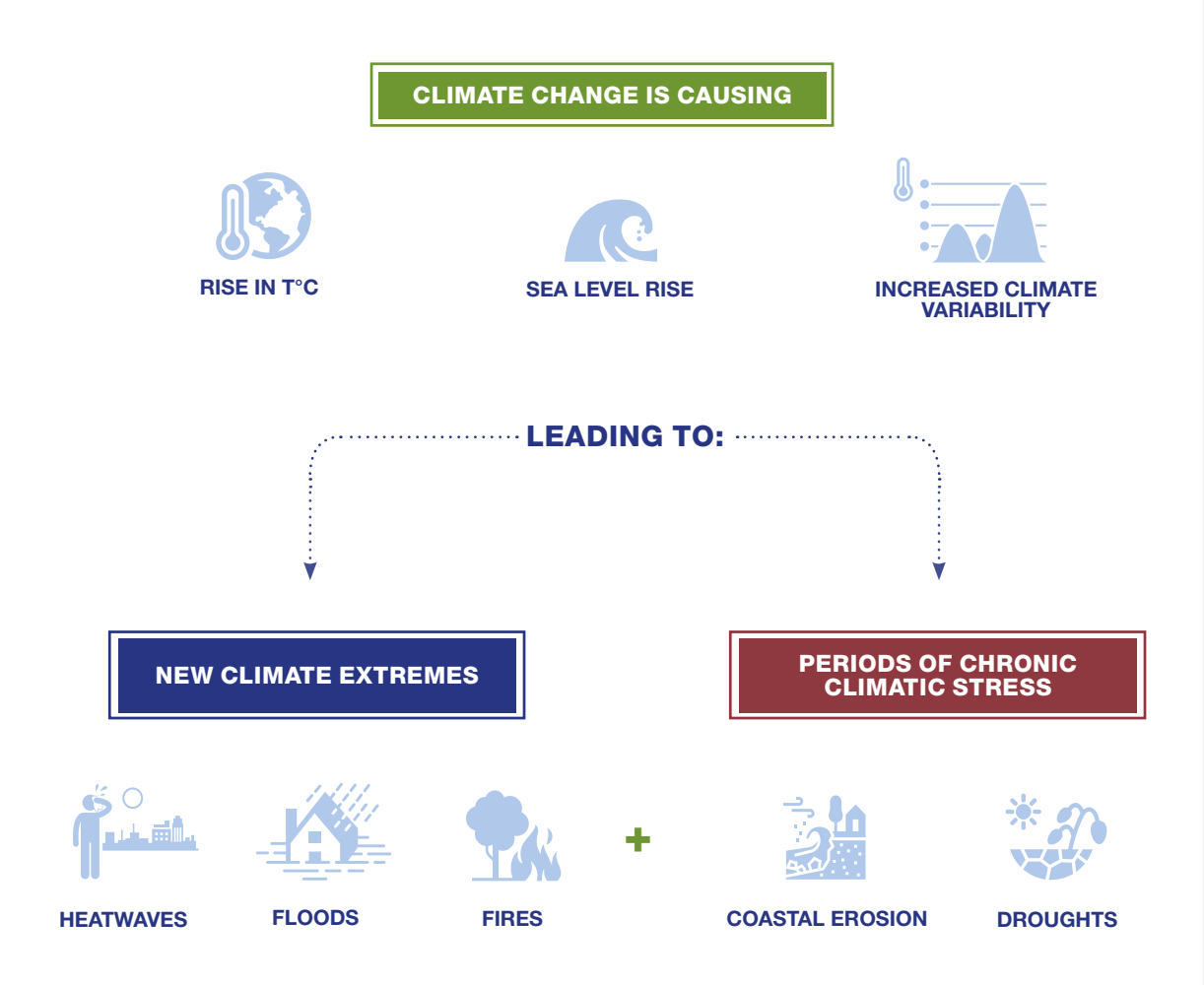
SUMMARY

SUPPORTING ADAPTATION TO CLIMATE CHANGE: WHAT DOES THIS MEAN?

Adaptation is about anticipating the negative effects of climate change and taking appropriate measures to prevent or minimise the damage that these effects may cause.

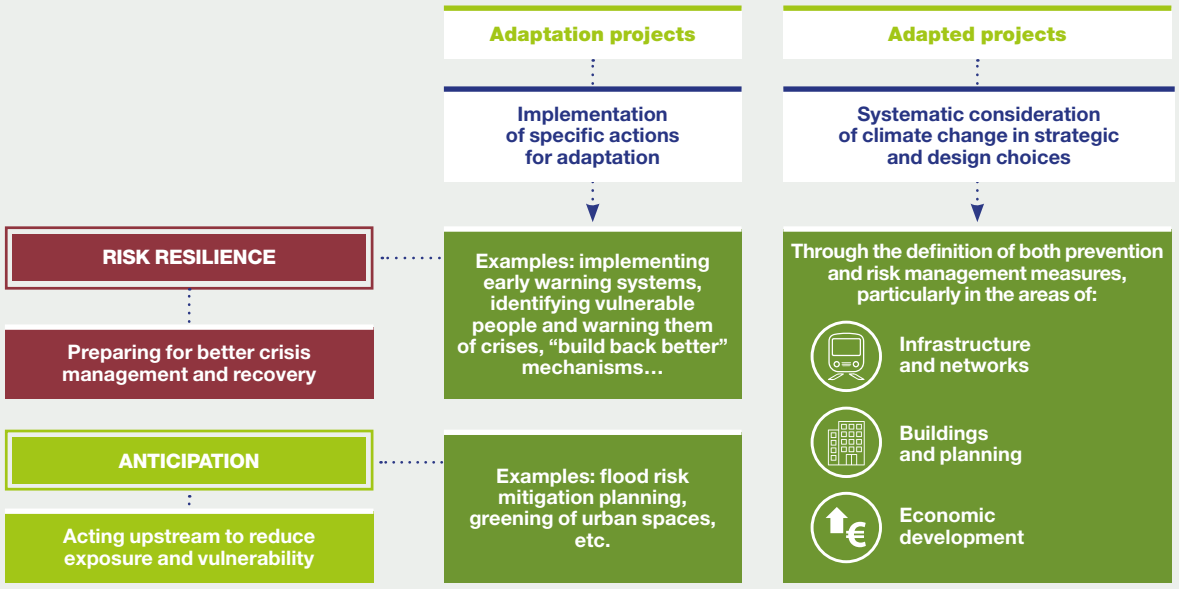
FIGURE 1: CLIMATE CHANGE EFFECTS: TRENDS, HAZARDS AND THEIR IMPACTS



In France, insured damages from natural disasters have already tripled since the 1980s to reach an average of 3.6 billion euros per year over the period 2016-2020 according to the French Insurance Federation (Fédération Française de l'Assurance, FFA) (Fondapol 2020). The French Prudential Supervision and Resolution Authority (Autorité de contrôle prudentiel et de resolution, ACPR) estimates that costs linked to natural disasters could increase by a factor of 5 to 6 in some French departments between 2020 and 2050 (ACPR 2021).

WHAT IS MEANT BY CONTRIBUTING TO ADAPTATION?

FIGURE 2: DIFFERENT FORMS AND MODALITIES OF ADAPTATION CONTRIBUTIONS



In many cases, we are not ready. Financial and human resources must be deployed to support adaptation to climate change in all regions. A significant number of climate change adaptation measures will rely on public intervention, in which Public Financial Institutions could play a role, and sometimes do already.

This study was primarily carried out to explore what this role might be in the French context. However, the challenge does not only relate to France, and Public Financial Institutions are a type of actor present in many countries, which share certain objectives and modes of action (Plihon and Rigot 2021).

WHY IS THIS AN ISSUE FOR PUBLIC FINANCIAL INSTITUTIONS?

Public Financial Institutions (PFIs), together with other public actors, have a particular responsibility to challenge and support local actors and to take climate change into account in financial models to support territorial adaptation:

- **Challenges are in line with their mandate:** adaptation is highly relevant to the areas in which they operate and their strategic objectives.
- **Historic role in accompanying major transformations** and a proactive capacity.
- **Assets to boost financing for adaptation** and drive private funding towards more adapted models:
  - Financial capacity;
  - Appropriate time horizons;
  - Genuine expertise to apply to quality projects.
- **Ability to combine public interest with the approach of a responsible financial actor with risk management expertise.**
- **Strategic interest in listening to the emerging demands of their clients and their environment** (peers, regulators, etc.).

TABLE 2 : – INTERSECTION OF THE MAJOR INTERVENTION AREAS AND SECTORS OF FRENCH PFIs AND THE MAIN ADAPTATION CHALLENGES IN FRANCE

MAJOR INTERVENTION AREAS AND SECTORS OF PFIs	WHY IS THIS AN ADAPTATION CHALLENGE?
 > Built environment and housing	— **Any new construction or renovation of buildings must ensure that they are safe,** comfortable to live in, and sustainable in changing temperature conditions – particularly longer, more intense or more frequent heatwaves – and given the changing physical constraints of the environment (e.g. shrink-swell capacity of clays).
 > Renovation of public buildings	— **There is a need to integrate the issue of summer comfort into the design of new buildings** and the energy retrofitting of the existing stock. This is an issue of public health, economics and energy (to avoid extensive use of air conditioning).
 > Spatial development, town planning, city centre renovation	— **The planning and redevelopment of urban spaces must take changes in climatic risks into account,** particularly flood risks (slow-onset floods or Mediterranean episodes) and the urban heat island effect. Spaces must be designed with safety, comfort and adaptability in mind, taking local situations into account. We must learn to live with risks by carrying out resilient development. Vegetation, water and soil permeability must be integrated as essential elements in urban projects to guarantee liveability and quality of life in the city.
 > Infrastructure and networks (mobility, energy, telecom, water)	— **Critical infrastructure (energy, transport, water, telecommunications)** must be able to provide the expected services in a range of changing climatic conditions (greater variability, amplitudes and recurrence of extreme events). Adaptation must be an issue of prioritisation, coordination and asset management (operation, maintenance, modernisation and development) for robust and resilient networks.
 > Economic development and support for priority sectors, support for SMEs	— **Climate changes must be regarded as an important trend in economic development policies:** from foresight to strategic investments; notably for particularly vulnerable sectors and supply chains such as forestry, certain agricultural sectors and tourism. It must be ensured that economic policy choices in which investments are made retain their viability and potential in a changing climate (for example with the reduced availability of water resources or snow).
 > Future of territories with high stakes, such as the coast, mountains and natural environments	— **Certain areas, such as the coast or the mountains, which also concentrate specific environmental,** economic and social issues, are also particularly sensitive to climate change. On the coast, the rise in sea level leads to an acceleration of coastal erosion phenomena and an increase in flood risk. In the mountains, temperature rises are particularly significant, snow cover decreases and geological risks (e.g. landslides) can be increased. The issue is to respond to the specificity of these challenges by dealing with local realities.
 > Local government investment	— **A large proportion of adaptation actions fall within the remit of local government,** particularly the administrative regions (economic development, planning) and that of inter-municipal authorities (town planning, housing, etc.). It is therefore essential to ensure that communities have clearly identified the issue of adaptation and have the means to integrate it into their actions.
 > Support for innovation	— **Although not all solutions are technical or technological,** adaptation raises new problems and therefore opens new fields of innovation, for example to find new construction solutions, to improve irrigation technologies or to find new ways of managing infrastructure. Finding suitable planning and development models that are economically viable is also a challenge that requires creativity. Supporting organisational innovation and experimentation is therefore also a challenge for adaptation[16].

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HOW CAN PFIs CONTRIBUTE TO ADAPTATION?

Due to their characteristics and intervention areas, PFIs must play a proactive role in adaptation. All PFI departments have levers to accelerate adaptation.

FIGURE 3: ADAPTATION, A SUBJECT FOR ALL PUBLIC FINANCIAL INSTITUTION DEPARTMENTS – AN OVERVIEW BASED ON THE FRENCH EXAMPLE

To contribute effectively to the challenge, PFIs will have to organise themselves, increase the skills of their teams on climate change adaptation, equip themselves with tools, and coordinate with each other and with other financial and technical assistance actors in territories.

Of course, PFIs will be unable to meet all adaptation needs singlehandedly. Their action would be more effective and coherent if they were part of a better defined and more ambitious public policy framework.

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INTRODUCTION

This report concludes the Finadapter project, which aims to better understand the conditions for systematically taking adaptation into account in territorial approaches and projects, and to explore the role that Public Financial Institutions (PFIs) could play in catalysing this adaptation.

It aims to develop and discuss the hypothesis that PFIs can play a crucial role in the development of territories adapted to climate change.

The analysis was first conducted for the benefit of public and financial actors in France. It has logically focused on how these issues unfold in the French context and takes as its starting point the current state of the consideration of adaptation in this country.[1]

Nevertheless, the concepts discussed, the issues described, and the requirements identified seem applicable for the enrichment of research in other national contexts.

Indeed, PFIs are a type of actor present in many countries that share certain objectives and modes of action (Plihon and Rigot 2021). The role they can play in adaptation is therefore a key question that remains relevant far beyond the French example, even if the answers will clearly vary (in terms of priorities, and the areas and types of intervention) depending on the context, and must be adapted to the structure, mandate, history and capacity for action of each PFI.

This translation does not therefore claim to provide a universal analysis or one that can be directly transposed to all situations, but rather serves as a contribution to the collective discussion by providing a detailed analysis of a national context and the proposals arising from this situation, one with which others may be able to identify.

The analysis is based on the results of the previous project phases, enabling the drawing up of an inventory of the major adaptation projects in France (I4CE and Ramboll 2020), and then the characterisation of the needs of those seeking to fully integrate this concern into the economic model of their projects or activities:

THE FINADAPTER PROJECT

The Finadapter project, conducted from 2019 to 2021 by I4CE and Ramboll France, was supported by the French Agency for ecological transition (Agence de la transition écologique, ADEME) under the ClimFi call for projects.

Finadapter project publications (in French):

1. **Overview of the major adaptation challenges in France** for a better understanding of issues and investment needs to contribute to the adaptation of French territories;

2. **Analysis of the economic challenges of mainstreaming adaptation to climate change in French territories.** Based on state-of-the-art adaptation as it is currently being deployed, this analysis characterises the difficulties encountered by those seeking to take this issue fully into account. Instead of questioning the economic impacts of climate change, it enables the analysis of the impact of effectively taking adaptation into account on economic models of territorial policies and projects;

3. **5 detailed case studies** providing an in situ understanding of the forms some of these challenges take.

1. As studied in previous work, that has not been translated into English (I4CE and Ramboll 2021)

I. CONTRIBUTING TO CLIMATE CHANGE ADAPTATION IN TERRITORIES: WHAT DOES THIS MEAN?

1. What is adaptation?

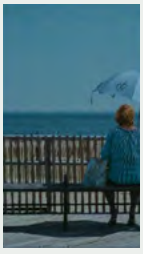
— Climate change is already a reality with which we must live, including in France where two-thirds of the population are already "highly or very highly" exposed to climate risks (Météo France 2020; Haut Conseil pour le Climat 2021). Even if all greenhouse gas emissions were immediately stopped and climate warming was limited to +1.5 or 2°C, we would still be unable to eliminate the climate change impacts that are already occurring (IPCC 2018; IPCC 2021). It is therefore necessary to anticipate and prepare for the consequences of climate change, i.e. to adapt.

Adaptation is about anticipating the negative effects of climate change and taking appropriate measures to prevent or minimise the damage that these effects may cause.[2]

Climate change consequences are numerous

— The negative effects in question are the consequences of rising temperatures, sea levels and climate variability, which are leading to increased risks of extreme events – e.g. heatwaves, floods, forest fires – and accentuating chronic stresses such as coastal erosion and prolonged droughts. Perhaps the most striking of these consequences is an increase in the number of disasters with the potential to cause casualties and severe damage to infrastructure and buildings.

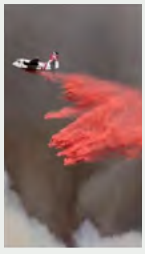
FIGURE 4: CLIMATE CHANGE CONSEQUENCES THAT ARE ALREADY EVIDENT



Extreme heat episodes
more frequent
more intense

Heavy rainfall
more frequent
more intense

Drought
increase
in some regions



Weather conditions that increase fire risk
more common

Oceans
warming
acidification
oxygen loss

Source : Valérie Masson-Delmotte, presentation of the IPCC 6th Assessment Report Working Group 1 results, August 2021

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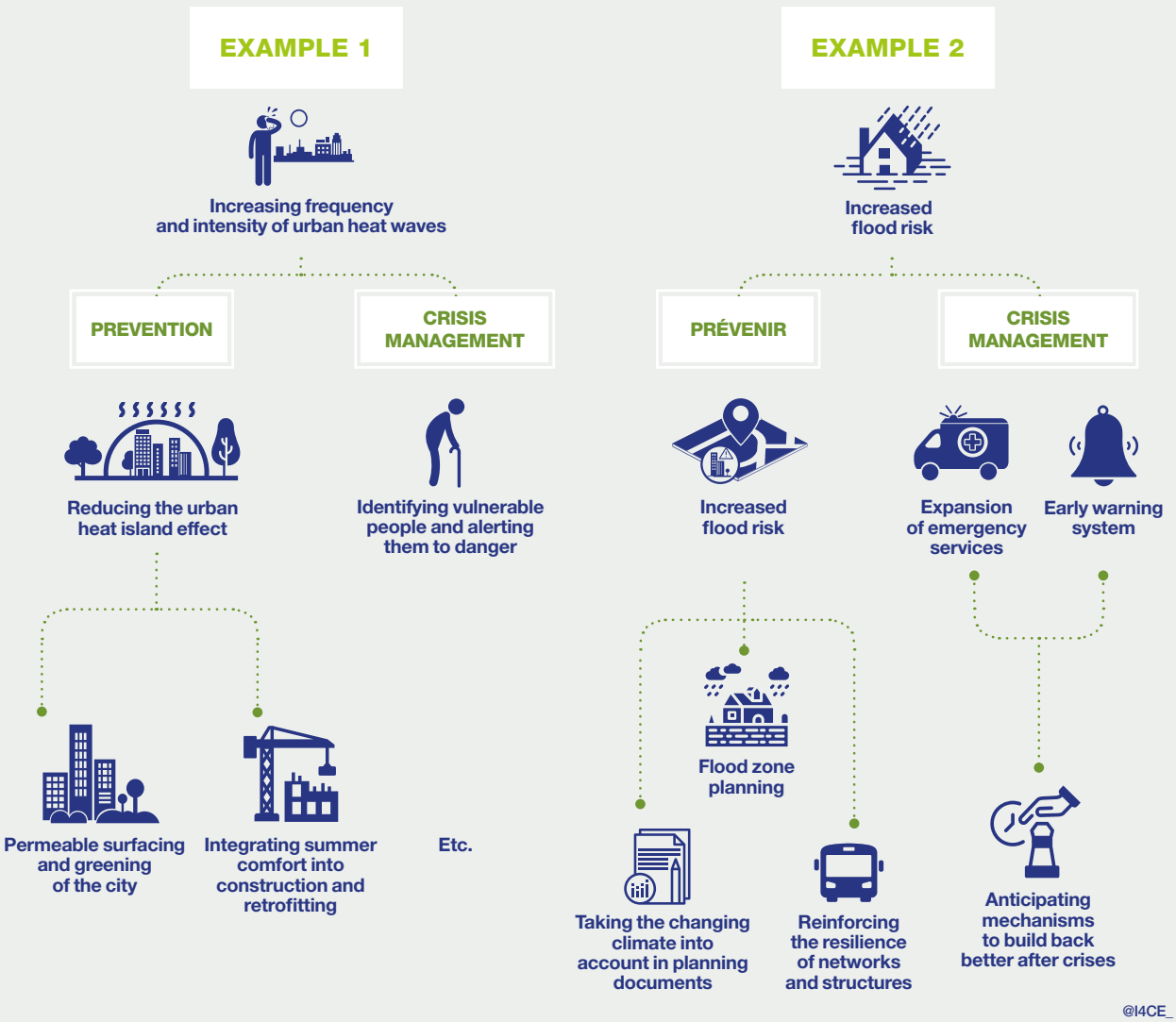
2. Definition inspired by the 2019 French Senate's Foresight Studies Delegation proposal. In certain cases or in the short term, the impacts of climate change may be positive for some actors (for example by improving local agricultural yields); adaptation in this case involves seizing the opportunities that may arise. However, the scientific consensus (IPCC 2018) is that these impacts are above all generators of risks and will mainly lead to negative consequences, particularly for the most vulnerable areas, activities and populations. The priority is therefore to limit these impacts as much as possible and to prevent these risks.

Even if disasters do not occur, economic sectors such as tourism in low mountain regions (reduced snow cover) or agriculture are becoming increasingly affected, a trend that will continue in future. In addition, there may be disruption to many daily activities: for example, during the summer months it may become difficult to work on building sites or to keep children in school, while for parts of the year there may be a drop in the safety and comfort of some urban areas and buildings.

Adapting means being better prepared to manage crisis situations more often, but also to anticipate the impacts to reduce risks

— Adapting therefore means being better prepared to manage crisis situations more often, but it also means taking these changes into account in planning, infrastructure construction and economic development choices. It means leaving room for water in a construction project, increasing permeable surfacing and the greening of cities to reduce the urban heat island effect; it means identifying vulnerable people and alerting them to danger, the more systematic integration of summer comfort into building construction and retrofitting, reinforcing the resilience of networks, reducing the water consumption of certain industrial activities, and supporting the diversification of mountain economies. Sometimes small adjustments may be sufficient, but often more radical transformations will be necessary. For example, farmers may start by considering changes to sowing dates or by improving the efficiency of irrigation systems, but there may also be a need to consider changing crop varieties or even the crop itself and the agricultural system.

FIGURE 5: TWO EXAMPLES OF MULTIPLE ADAPTATION ACTIONS THAT NEED TO BE COMBINED



TERMS THAT SHOULD NOT BE CONFUSED

• **ADAPTATION AND MITIGATION:** Adaptation is different to mitigation, the latter focusing on reducing greenhouse gas emissions. Adaptation and mitigation are complementary: it is necessary to adapt to the climate changes that are already here (that we were unable to avoid) but we cannot continue to emit greenhouse gases because beyond certain levels of warming, adaptation would become too costly (economically and in terms of human lives) or even impossible ("every half-degree counts" (IPCC 2018)). Adaptation is about "managing unavoidable changes" while mitigation is about "avoiding unmanageable changes" (Délégation sénatoriale à la prospective 2019).

• **ADAPTATION AND PREVENTION OF NATURAL RISKS:** Until now, the prevention of risks, such as floods, has been based on a well-established definition of hazards and their likelihood of happening: we prepare for known events that have already been experienced. However, climate change is modifying the types and levels of risk: events are happening with greater intensity and frequency, as well as series or combinations of events that have not been experienced before. Adaptation therefore also implies taking climate projections into account, which highlight a greater diversity of possible future climates and moving from risk management methods based on known occurrence probabilities to methods based on uncertainty.

However, "we are not ready" for the consequences of these changes: whether drastic – e.g. an increase in natural disasters – or more gradual – e.g. rising sea levels, pressure on water resources – (Délégation sénatoriale à la prospective 2019). Investment in terms of human and financial resources to improve the anticipation of developments remains scarce (I4CE 2021a). The customs and practices inherited from a climate that was considered stable and under control have not been challenged, including on the critical scale of territorial planning and economic development. For this reason, the French High Council on Climate wrote in its 2021 annual report, "the implementation of adaptation must be accelerated and planned and existing policies must be made consistent" with this objective (Haut Conseil pour le Climat 2021). Following a period of multiple experiments, now is the time to generalise the consideration of climate change adaptation to territorial policies and projects.

2. The main needs for adaptation: adapted governance, financial and human resources

— Any discussion on financing adaptation therefore involves liaising with actors, both public and private, with responsibility for each of the areas concerned, to determine, with their input, the implications of taking climate change into account in their decisions and their action programmes, and what new needs this generates. Several salient points emerged when the actors concerned were asked about adaptation needs:

Finding the means to make the adaptation issue a reality

— There will be "no adaptation without operational requirements and human resources" (I4CE 2021a). If we want to rise to the challenge of adapting to climate change, we must provide ourselves with the means to make the national strategy operational. The first challenge in moving towards an economy and territories with the capacity to adapt to ongoing climate change is to put the necessary smart-design into territorial approaches and projects so that they systematically integrate this dimension. Our analyses of the adaptation dynamics as they are emerging in France highlight the importance of dedicating time and technical assistance upstream to bring about the emergence of adapted approaches and projects and therefore opportunities to invest in adaptation and to finance such projects (I4CE and Ramboll 2021a; 2021b).

Since adaptation requires the organisation of collective choices in the face of uncertainty and because it is potentially itself a source of uncertainty – linked particularly to the lack of feedback – and because it often involves many actors, going beyond the usual administrative frameworks and being a source of tension or even conflict, it poses a challenge above all in terms of governance. As a result, the spaces, times and institutional arrangements that define an "enabling environment" for the structuring of socially acceptable and economically viable projects are of crucial importance (OECD 2015).

Addressing this issue means, among other things, providing human and financial resources to:

- **Generate knowledge and information** to support the development of a shared understanding and outlook as well as the emergence of economic signals and common indicators, to enable decision-makers to increase their skills and to capitalise on adaptation experiences.
- **Facilitate** resource mobilisation – particularly human resources – to bring the subject to life, to lead foresight and consultation processes, to network and link up initiatives.
- **Provide coordination-mediation** to cover the costs of an institutional and legal environment favourable to adaptation – for example, coordination costs for water governance and the facilitation of arbitration mechanisms for use conflicts (mediation).

These points have been analysed in detail (I4CE and Ramboll 2021b) and illustrated and expanded upon in the five case studies conducted and published as part of the Finadapter project.[3]

Developing adaptation projects and, above all, adapted projects

— However, an environment that is conducive to adaptation is insufficient to ensure that the adaptation of territories and the economy actually takes place. Projects must also be facilitated, structured and implemented. This facilitation sometimes involves specific actions with the primary purpose of adaptation – referred to here as "adaptation projects" (or adaptive projects, which enable the adaptation of other activities)[4], but they are more often modalities for systematically taking climate change into account in the strategic choices and design of structuring territorial projects[5] carried out for other purposes (e.g. planning choices and projects or infrastructure development) – referred to here as "adapted projects".

TABLEAU 1: A DOUBLE FUNDING CHALLENGE

WHERE SUPPORT IS NEEDED	CHALLENGE IN TERMS OF FUNDING NEEDS
Specific actions with the primary purpose of avoiding or limiting the negative impacts of climate change and/or to seizing the opportunities they generate.	Supporting the development of a pipeline of **adaptation projects** (or "adaptive" projects), i.e. schemes or investments with the primary purpose of avoiding or limiting the negative impacts of climate change and/or seizing the opportunities they generate.
Procedures for systematically taking climatic change into account in strategic choices and in the design of structural territorial projects.	Guaranteeing the generalisation of **adapted projects,** i.e. systematically taking climatic change into account in strategic choices and in the design of funded structural territorial projects.

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Whether enabling the emergence of adaptation projects or adapted projects, it takes time and expertise to identify relevant projects and to integrate climate change into their design.

Financing investments and the additional costs of adaptation

— When the issue is explicitly raised and addressed from the design phases of approaches and projects, the cost of its implementation can be negligible (i.e. the adapted options selected do not cost more than the non-adapted options in a baseline situation), however this is not always the case. The implementation of adaptation can sometimes require ad hoc actions and investments, while in other instances modifications in the functional and technical choices of projects are needed, which can represent additional costs.

Nevertheless, the economic literature shows that the benefits of adaptation are systematically greater than these costs, and that early action avoids much greater costs in future arising from climate change impacts for which we would be unprepared (Global Commission on Adaptation 2019). In the absence of adaptation, the cost of damage caused by climate change impacts in Europe would represent between 100 and 200 billion dollars per year by 2050, which would be significantly reduced by adaptation measures (COACCH 2021).

Investing in adaptation is therefore economically and socially beneficial and the question arises concerning who will make

3. Available (in French) on the I4CE website https://www.i4ce.org/go_project/finadapter/

4. Vocabulary used in the European Taxonomy to designate projects enabling adaptation.

5. Structuring projects refer to planning, infrastructure or economic development initiatives which, due to their long lifespan, their low reversibility and their influence on other decisions, establish pathway choices with consequences that can last over several decades.

the necessary investments when the benefits will be collective. To address this question, the following two issues should be considered:

• In the case of "adapted" projects, potential additional costs related to adaptation measures must be integrated into the economic calculations of investments:

1. **Initial additional costs.** These additional costs (for example the installation of equipment to protect industrial sites against flood risks or to provide solar shading for buildings) may be low compared to total project costs or more significant depending on the context.

2. **Additional operating costs.** The dynamic and evolving nature of adaptation strategies and the nature of the actions deployed – which can be technological but also organisational – sometimes lead to the identification of additional costs in the operation and management of equipment and activities. Monitoring, maintenance and management that take better account of climatic conditions and local vulnerabilities require appropriate resources.

The extent of these additional costs varies greatly from one project to another, depending on the context, the level of risk involved, the type of impact in question, etc. For the project to be adapted and to anticipate the financing of these potential additional costs, it is important that these issues and needs are sufficiently analysed upstream.

• New investments specific to adaptation may also be necessary in certain situations:

1. **Specific dedicated investments.** In some cases, the choice of adapted pathways generates specific needs, for example in terms of risk management with protective grey infrastructure (e.g. dykes, concrete structures) or green infrastructure (nature-based solutions) or the constitution of emergency stocks, backup mechanisms, the development of warning systems, etc. Certain ambitious strategies may even involve potentially significant fixed costs, for example for land mobilisation. Sometimes this concerns adaptation expenses attached to investments carried out for other purposes, such as the acquisition of a farm irrigation management system, or the development of green spaces or water features within urban projects.

2. **Costs related to end-of-life assets and stranded assets.** Finally, it is necessary to anticipate the management of stocks of assets already in existence, whose end of life could represent potentially significant fixed costs – although no consolidated assessment exists to date. These stocks include old facilities or infrastructure that has already amortized, but its dismantling would generate costs which often have not been considered. Examples include ski lifts in mountain resorts where skiing has ceased (Mountain Wildernes 2018). Another example is buildings in coastal areas where rewilding is necessary due to rising sea levels. To this is added the cost of so-called "stranded" assets, i.e. those that have not yet depreciated but which lose value due to a shift of certain activities towards an adapted pathway, for example snow cannons that have not yet delivered a profit when the resort ceases activity, or recent agricultural installations which are no longer necessary due to cropping changes. Finally, this issue also refers to the covering of social costs (e.g. guarantees of rights) linked to the early termination of certain activities.

FIGURE 6 : MAIN TYPES OF HUMAN AND FINANCIAL RESOURCES TO BE MOBILISED FOR ADAPTATION

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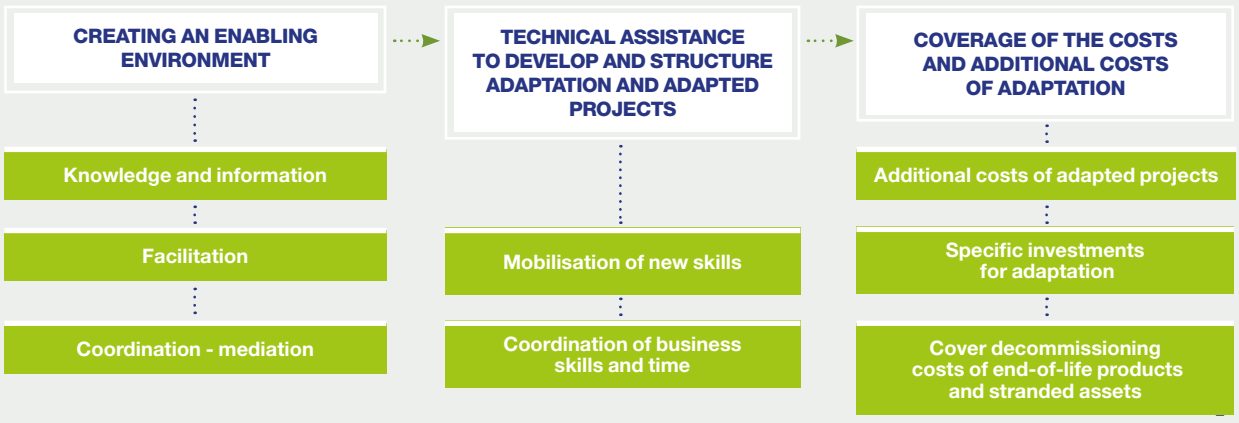

II. THE MANDATES OF PUBLIC FINANCIAL INSTITUTIONS REQUIRE THEIR PROACTIVITY AND CONTRIBUTION TO CLIMATE CHANGE ADAPTATION

1. A significant proportion of climate change adaptation measures will be based on public intervention

The widely established scientific consensus is that the private and public sectors have a role to play in the design and implementation of adaptation measures (IPCC 2014). Indeed, while some adaptation depends on the strategic choices and risk management practices of each economic actor and can be described as uncoordinated and unplanned, a significant proportion does not share these characteristics and will therefore be based on public intervention (Sainz de Murieta, Galarraga, and Markandya 2014; Hallegatte et al. 2018).

Adaptation presents collective benefits that are poorly valued in individual economic models

— This need for public intervention can be explained both by the characteristics of adaptation actions and by their conditions of implementation. It is often the strong collective component of adaptation that proves problematic. Indeed, the action or non-action of certain actors can have direct consequences (externalities) on the adaptive capacity of others (Heuson, Gawel, and Lehmann 2014; Schneider 2014). For example, the construction of water reservoirs by farmers has impacts on the availability of the resource for other users in the watershed. Moreover, those who are technically or financially able to deploy adaptation actions are not always those who will reap the benefits (Tompkins and Eakin 2012).

Among the cases analysed as part of the Finadapter project (I4CE and Ramboll 2021b) notable situations were observed where adaptation involves:

- **Short-term additional costs but without benefits that can be directly valued in current economic models.** Economic signals take time to emerge, for example: there is no clear price signal for resilience in property markets; a building in a risk zone in France will not always cost less, which is not always the case in other countries[6]; and a particularly efficient building in terms of summer comfort is not necessarily valued more highly. As the markets have not yet taken these risks into account, their reduction does not result in economic benefit. Thus, the additional cost of adaptation action is not generally, and for the moment not usually offset, by a benefit that can be valued in the economic model of an individual actor. Therefore, those currently paying for goods, equipment or services are generally not willing to pay more for versions of the same goods, equipment or services that would be adapted to climate change;

- **Favouring models which, although remaining economically viable, are less profitable in the short term compared to non-adapted models** (for example, the decision to invest in "four-season" mountain tourism, rather than equipping a resort with artificial snowmaking equipment or by favouring more diverse forest stands and more resilient forest management);

- **Deciding not to build and therefore giving up any potential benefits.**

Some of these situations, which are characterised by interdependencies between the choices of different actors and in which the adaptation benefits are appreciated above all in collective terms, justify public intervention (OECD 2008; de Perthuis, Hallegatte, and Lecocq 2010).

6. In France this is particularly due to the existence of the natural disaster insurance system which makes this risk more collective. In countries lacking such a system, we are beginning to observe situations in which the economic signal is emerging more clearly, see for example in Florida (McAlpine and Porter 2018) or the United Kingdom (First Street Foundation 2019).

Sometimes "transformational" actions are necessary

— More fundamentally, adaptation goes beyond the simple need for marginal adjustments. Certain climate change consequences even call into question the sustainability of facilities or activities in territories – for example, construction in flood plains. When adaptation becomes "transformational" (Comité 21 2020; Simonet 2020; Kates, Travis, and Wilbanks 2012), adapting involves collective choices[7] regarding economic development or planning. In a democratic context, these choices and, even more so, the pathways designed for their realisation, can only be the result of a process of deliberation within shared governance structures (Mees, Driessen, and Runhaar 2012).

Two complementary requirements for public intervention

— These considerations outline **two requirements for public action** in terms of climate change adaptation (Sainz de Mureta, Galarraga, and Markandya 2014; Hallegatte et al. 2018):

1. **The requirement for coordination** to ensure that all adaptation actions undertaken by actors over time (with a proportion of adaptation taking the form of actions that organisations implement themselves to independently reduce their own risks) are as beneficial as possible in collective terms. Responding to this challenge involves creating a conducive environment for adaptation (i.e. establishing incentives, norms, standards, information sharing, etc.) and by structuring the necessary governance so that major collective choices are made regarding the approach to adopt when confronted with climate change consequences.

2. **The requirement for public authorities to take direct charge of certain adaptation actions** when they concern public goods. These include the production of infrastructure or services that will condition the economy's ability to cope with climate change.

To achieve this, all the classic public action tools can be mobilised (OECD 2015): information provision, public investment, the establishment of incentives (taxes, for example), regulation or even financing tools (direct support for certain actions, mandates entrusted to public agencies, public-private partnerships, risk-sharing instruments, etc.).

▸▸ PFIs seem to be relevant actors in terms of responding to some of these challenges as part of more comprehensive action by States, its operators and local authorities.

2. A role for public financial institutions in climate change adaptation

— PFIs are defined here as "any type of financial institution which is owned and/or controlled by at least one state or local authority with an explicit legal mandate to achieve varying degrees of socio-economic objectives in a region or sector" (Plihon and Rigot 2021)[8]. These include public banks "whose functions are not limited to traditional banking services but who contribute to the achievement of public objectives" *(ibid)*.

In mainland France, this includes the Caisse des Dépôts – particularly *via* the Banque des Territoires – and its various banking subsidiaries – Bpifrance, Banque Postale, SFIL – of the European Investment Bank; the Agence France Locale (AFL); Crédits municipaux and the Agence Française de Développement (AFD) for activities in French overseas territories[9].

7. The notion of choice is particularly important in this context: there is rarely only one available adaptation option but a variety of possible approaches that depend notably on the level of risk deemed acceptable - it is this level of acceptability and the chosen collective approach that must be at the centre of collective discussions.

8. To derive this definition, the authors carried out a "multi-criteria analysis, the main criteria being public ownership and control, the existence of objectives of public interest, the nature of the resources and financing instruments, and the types of borrowers and targeted sectors." They note that only the combination of the first two criteria correspond to the lowest common denominator of PFIs.

9. Overseas territories are particularly exposed to climate change impacts and present significant and specific challenges in terms of adaptation that we have not explored in depth in this report (ONERC 2012).

A concern that resonates with their historical role and expertise

— These organisations have historically played a major role both in overcoming the limits of private investment in sectors characterised by market failures, and in facilitating the deployment of the development visions supported by the State and other public actors, the most significant of which are local authorities (Cochran et al. 2014; Thiveaud 2016; Fretigny 2015; Hayez and Savel 2018).

They are particularly active in the financing of infrastructure and public goods more generally; their action is countercyclical, making it possible to mitigate economic shocks on investment streams, and they can support long-term transformations and catalyse the knock-on effects of private finance.

For example, the Caisse des Dépôts group defines its mission statement as follows: "We support public policies and work towards economic, social and sustainable development. Serving the public interest means protecting the savings of French people, supporting our economy, and making everyday life easier for everyone, especially the most vulnerable." Agence France Locale (AFL) presents its own as follows: "AFL is the response of the local community to the issue of local authority financing and has a unique objective: to finance the investment of member communities, whatever their size or type."

To fulfil their aims, PFIs can rely on valuable assets including an ability to provide long-term or even very long-term loans, to be a patient investor, to provide financing conditions in certain contexts that are better than those of the market, to offer services at each stage of a project, to take on a greater share of risk, to capitalize on and mobilize a rich and diverse expertise, and to offer loans to finance technical assistance (Cochran et al. 2014; Griffith-Jones, Attridge, and Gouett 2020; Griffith-Jones and Tyson 2013; Plihon and Rigot 2021; Macfarlane and Mazzucato 2018).

These assets and skills appear particularly relevant to address the challenges generated by adaptation and to provide solutions to the economic problems raised.

At the same time, these strengths make PFIs particularly exposed to risks linked to future changes in the climate. The long-term loan repayments – of 30, 40, or even 60 years – that they grant will be directly impacted by the resilience of their counterparts to climate change impacts. Indeed, if the financial viability of their counterparts is severely undermined by the impacts of climate change, their ability to repay their loans will be called into question. Similarly, the investments that PFIs make today, for 10, 15 years, or even more, could already be impacted by climate change. It is therefore essential that PFIs take an interest in the adaptation capacities of their counterparts from a financial analysis and risk management perspective.

Major actors in current transitions

— The role of these institutions in achieving climate objectives is becoming increasingly evident (the European Investment Bank defines itself as the "European climate bank[11]"; in 2020 the Banque des Territoires and Bpifrance presented their joint Climate Plan for the period 2020-2024)[12]. However, while the transition to a low-carbon economy remains the best known and monitored objective (I4CE 2019b), adaptation is also one of the goals that was defined in the 2015 Paris Agreement and is being implemented at European, national and local levels.

At the European level, in 2021 the European Commission presented its new adaptation strategy (European Commission 2021) in which the role of PFIs, first and foremost the EIB, is clearly identified. A first operational application of the guidelines provided by this strategy is the update of criteria for taking climate issues into account in infrastructure projects that will be funded under the European Green Deal (EIB 2020)[13].

In France, the National Climate Change Adaptation Plan (Plan National d'Adaptation aux changements climatiques, PNACC2) questions the way in which the State and local authorities design and conduct planning policies (mountains, coastal, infrastructure modernisation) and economic development (in terms of tourism for example) of which the PFIs are one of the key operators.

At the territorial level, adaptation is an issue that is increasingly identified by regional administrations as well as a mandatory component of Territorial Climate-Air-Energy Plans (Plans climat-air-énergie territoriaux, PCAET). As and when this concern is appropriated by these different actors, PFIs will be invited to participate. This can already be

11. See https://www.eib.org/en/about/priorities/climate-action/index.htm

12. See https://www.caissedesdepots.fr/actualites/banque-des-territoires-et-bpifrance-un-plan-climat-de-40-mdeu

13. See https://ec.europa.eu/regional_policy/en/newsroom/news/2021/07/29-07-2021-commission-adopts-new-guidance-on-how-to-climate-proof-future-infrastructure-projects.

observed in certain major thematic programmes, such as the Future Mountain Plan (Plan Avenir Montagne) presented by the French government in 2021, where adaptation is a central concern and in which the Banques des Territoires and Bpifrance participate[14].

The climate agenda to which the PFIs actively contribute is therefore also an adaptation agenda. PFIs can play a role in supporting the implementation of the national adaptation policy, particularly in its transformational aspects, due to their ability to provide long-term financing and to cover areas not yet reached by other funders. They can also set an example by ensuring that adaptation is considered in the deployment of major State-led guidelines that they implement, for example in the policies of infrastructure modernisation, territorial revitalisation and cohesion (*via* programmes such as Action Cœur de Ville or the EcoCité initiative).

THE "RISK" AND "REPORTING" AGENDA

PFIs are also invited to change their practices to take climate change into account *via* another dynamic, that is more directly financial and linked to changes in risk regulations.

In line with the work initiated by the Task Force on Climate-Related Financial Disclosures in 2015 (Carney 2020) financial institutions and their regulators are increasingly sensitive to their exposure to climate change-related risks, including the physical risks to assets caused by changes in the climate (change in average temperature and rainfall patterns, increase in the frequency and severity of extreme weather events ...).

New European (Sustainable Finance Disclosure Regulation) and French (Article 29 of the Energy Climate Law of 2021) requirements call for financial actors to report on the risk exposure of their activities, as well as on the action plans they implement to reduce these risks and to adapt.

To date, physical risks remain difficult to assess at the portfolio level due to the state of maturity of the methodologies and available data (I4CE and CICERO 2021; ACPR 2021). However, financial institutions are also invited to assess the risks at the level of their counterparts and their projects, and this assessment, which takes time but is fully accessible given the state of available knowledge, can be a very good entry point towards an adaptation process.

EUROPEAN TAXONOMY

The development by the European Commission of the European Taxonomy on green activities (European Commission 2020) constitutes another dynamic that goes beyond transparency obligations and encourages consideration of the redirection of capital towards activities compatible with environmental objectives, including adaptation. The taxonomy gives a definition of adapted activities and activities that contribute to adaptation (adaptive). It proposes an approach to assess whether funded activities do not, at the very least, significantly harm adaptation and to characterise the substantial contributions or co-benefits of these activities in this area (European Commission 2021). This approach is said to be "process-based", i.e. that rather than defining a positive list of actions that contribute to adaptation that is valid in all circumstances, it proposes a set of criteria and steps that enable the assessment, in context, of the consideration of this issue in a specific activity or asset. If the operationalisation of this approach remains challenging, the regulatory nature of the taxonomy is likely to be a driving force by allowing companies to formally demonstrate their contribution to adaptation and by proposing a common framework to identify and develop practices that do not sufficiently integrate this dimension[15].

The invitation to contribute to adaptation dynamics can also come from PFI counterparts themselves. During this work, we identified demands that were directly addressed to them, relating to urban development, water supply, forest renewal and the diversification of tourism in mid-mountain areas. Some of these demands were addressed in the framework of standard PFI services (for example through technical assistance) or led to the development of new services.

Critical areas of intervention for the adaptation of territories to climate change

— PFI mandates are very directly linked to the major challenges of adaptation to climate change. Indeed, the first challenge in terms of adaptation is to ensure that the decisions taken today, which engage in long-term development pathways that will be difficult to reverse, take the current and future climate changes into account.

14. See https://www.gouvernement.fr/partage/12300-presentation-du-plan-avenir-montagnes

15. The "process-based" approach enables the characterisation of activities for which a quantitative threshold or a predefined list of qualitative requirements does not work well, because the thresholds or the criteria can only be defined by taking each context into account. For a detailed analysis of adaptation in taxonomy, see https://www.carbone4.com/analyse-adaptation-climat-taxonomie-europeenne

TABLE 2 : – INTERSECTION OF THE MAJOR INTERVENTION AREAS AND SECTORS OF FRENCH PFIs AND THE MAIN ADAPTATION CHALLENGES IN FRANCE

MAJOR INTERVENTION AREAS AND SECTORS OF PFIs	WHY IS THIS AN ADAPTATION CHALLENGE?
> Built environment and housing	**— Any new construction or renovation of buildings must ensure that they are safe,** comfortable to live in, and sustainable in changing temperature conditions – particularly longer, more intense or more frequent heatwaves – and given the changing physical constraints of the environment (e.g. shrink-swell capacity of clays).
> Renovation of public buildings	**— There is a need to integrate the issue of summer comfort into the design of new buildings** and the energy retrofitting of the existing stock. This is an issue of public health, economics and energy (to avoid extensive use of air conditioning).
> Spatial development, town planning, city centre renovation	**— The planning and redevelopment of urban spaces must take changes in climatic risks into account,** particularly flood risks (slow-onset floods or Mediterranean episodes) and the urban heat island effect. Spaces must be designed with safety, comfort and adaptability in mind, taking local situations into account. We must learn to live with risks by carrying out resilient development. Vegetation, water and soil permeability must be integrated as essential elements in urban projects to guarantee liveability and quality of life in the city.
> Infrastructure and networks (mobility, energy, telecom, water)	**— Critical infrastructure (energy, transport, water, telecommunications)** must be able to provide the expected services in a range of changing climatic conditions (greater variability, amplitudes and recurrence of extreme events). Adaptation must be an issue of prioritisation, coordination and asset management (operation, maintenance, modernisation and development) for robust and resilient networks.
> Economic development and support for priority sectors, support for SMEs	**— Climate changes must be regarded as an important trend in economic development policies:** from foresight to strategic investments; notably for particularly vulnerable sectors and supply chains such as forestry, certain agricultural sectors and tourism. It must be ensured that economic policy choices in which investments are made retain their viability and potential in a changing climate (for example with the reduced availability of water resources or snow).
> Future of territories with high stakes, such as the coast, mountains and natural environments	**— Certain areas, such as the coast or the mountains, which also concentrate specific environmental,** economic and social issues, are also particularly sensitive to climate change. On the coast, the rise in sea level leads to an acceleration of coastal erosion phenomena and an increase in flood risk. In the mountains, temperature rises are particularly significant, snow cover decreases and geological risks (e.g. landslides) can be increased. The issue is to respond to the specificity of these challenges by dealing with local realities.
> Local government investment	**— A large proportion of adaptation actions fall within the remit of local government,** particularly the administrative regions (economic development, planning) and that of inter-municipal authorities (town planning, housing, etc.). It is therefore essential to ensure that communities have clearly identified the issue of adaptation and have the means to integrate it into their actions.
> Support for innovation	**— Although not all solutions are technical or technological,** adaptation raises new problems and therefore opens new fields of innovation, for example to find new construction solutions, to improve irrigation technologies or to find new ways of managing infrastructure. Finding suitable planning and development models that are economically viable is also a challenge that requires creativity. Supporting organisational innovation and experimentation is therefore also a challenge for adaptation[16].

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16. These challenges arise in similar terms for other issues such as biodiversity conservation (CDC-Biodiversité 2021), energy efficiency and the evolution of urban economic models (Baraud-Serfaty, Rio, and Fourchy 2017). PFIs are already directly involved in exploring some of these topics - for example by taking part in the payment for environmental services experiment (CDC-Biodiversité 2021; ONERC 2019) – and could well deepen and diversify them with a view to adapting to climate change.

Despite this apparent convergence between PFI roles and practices and the challenges of climate change adaptation, this objective remains the poor relation of climate action by public financial institutions in France. Adaptation is gradually emerging on certain themes but is still too marginal compared to the scale of the needs and to the potential of PFIs to contribute to all their activities. There remains much work to be done to ensure that each service concerned takes ownership of the topic within financial institutions.

A LONG-ESTABLISHED CONCERN OF PUBLIC BANKS OPERATING IN DEVELOPING COUNTRIES

Climate change adaptation is an objective with which PFIs operating in a developing country context are more familiar:

- Firstly because adaptation is a long-standing subject in international climate negotiations and particularly in the financial commitments of northern countries (climate finance agenda) (Magnan et al. 2020; Mogelgaard, McGray, and Amerasinghe 2015; IDFC 2018; 2015)[17];
- And secondly because the exposure to climate risks and the vulnerability of countries in which these PFIs operate are greater and better perceived (due to their geography but also their economic, political and social structures). In 2020, the multilateral development banks thus allocated USD 16.1 billion, or 24% of their climate finance to adaptation (Group of Multilateral Development Banks 2020), while the members of the IDFC gave USD 23 billion for adaptation (including 4 billion concerning both mitigation and adaptation) from their climate finance total of 187 billion (IDFC 2020).

Adaptation is therefore an integral part of AFD's commitment to be a "100% Paris Agreement" bank and to dedicate "at least 50% of annual financing goes to projects that have a direct and beneficial impact on the climate". However, adaptation has remained less present in the European and French context until now.

III. A SUBJECT FOR ALL IN PUBLIC FINANCIAL INSTITUTIONS

1. General management: establish climate change adaptation as a high-level strategic priority

A prerequisite for assertive action by PFIs will be to explicitly establish the aim to contribute to territorial adaptation as an objective supported at a high level – by the top management of PFIs, their board of directors and/or supervisory committees – and explicitly stated among the strategic priorities of each institution.

Indeed, in 2021 adaptation remains barely present or non-existent in the strategic guidelines of the main French PFIs. Although it is occasionally mentioned, for example in the Climate Plan of the Banque des Territoires and Bpifrance which touches on infrastructure and network resilience, it is either in a very *ad hoc* manner[18] or very generically included in broader climate objectives.

In 2015, based on a systematic review of development bank practices, I4CE proposed a methodological framework

17. The objective of the 2015 Paris Climate Agreement is to align all financial flows with the objectives of mitigation and adaptation (article 2c). The Agreement also reaffirms the obligation of developed countries to support the efforts of developing countries. In this support, the provision of financial resources aims to strike a balance between adaptation and mitigation. See https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement/key-aspects-of-the-paris-agreement

18. For example, we can find a reference to adaptation in the Strategic Plan of the Banque des Territoires 2020-2024 but only in the specific "Environment and biodiversity" field of intervention, for which the following objective is stated "Enable everyone, everywhere in the region […] to benefit from a living environment adapted to the climatic conditions of today and tomorrow and to develop the circular economy." One of the development actions identified consists of "Supporting local authorities in adapting to climate change." See https://www.banquedesterritoires.fr/sites/default/files/2021-05/BANQUE%20DES%20TERRITOIRES%20-%20Plan%20Strat%C3%A9gique%202020%20-%202024.pdf

for the systematic mainstreaming of climate into decision-making (I4CE 2015). Primarily relevant for initiating the alignment of activities with a pathway to reduce greenhouse gas emissions, certain elements of this framework can also guide the management of adaptation. This analysis proposed to consider the integration of climate concerns at **two levels** : an upstream strategic level and (ii) a downstream project level. Transposed to adaptation this would mean:

1 **At a strategic level,** the definition of guidelines and action priorities that are compatible with the long-term objective of a viable economy and habitable territories in a climate change context.

2 **At the project level,** the definition of evaluation criteria that would enable the elimination of projects that would be incompatible with this objective (because they would be intrinsically unadapted – for example an irrigated agricultural project in an area facing significant water shortages – or poorly adapted – i.e. that would exacerbate the dangers associated with climate change) and guiding principles to improve the projects under examination so that they take best account of the possible adaptation criteria.

Between these two levels, general management will have to give impetus to the translation of strategic guidelines into operational objectives for each occupation, organise training and skills development for teams, ensure that these teams have the necessary tools to achieve these objectives, and finally steer the implementation of these guidelines over time.

A JOINT INITIATIVE ON ADAPTATION?

On other subjects, such as transition, some progress is also made possible through joint initiatives at the international level which encourage each PFI to announce ambitious objectives and action plans and to implement dynamics of mutual emulation. Such objectives are sometimes less easy to define and promote in terms of adaptation, but they could take shape by capitalizing on methodological advances (I4CE 2019b; Mullan and Ranger 2021) and an increasingly ambitious European institutional context regarding adaptation (European Commission 2021).

Proactive action on this subject within the networks and clubs to which the PFIs belong (e.g. European Long-Term Investors Association, IDFC) could, by identifying and exchanging best practices, enable the emergence of such an initiative.

2. Territorial management: initiating a dialogue with counterparts

— Adaptation remains mainly an emerging subject for many economic and territorial actors. The challenges – when known – can appear technical, while the solutions, that are often contextual and composite, are poorly identified. Through direct interactions with project leaders, PFIs, *via* their teams present in territories and their dialogue with clients, can help ensure that the question is asked more often and in a better way.

They can raise the issue in discussions with elected officials, business representatives and other funders to share a vision of the main local challenges; they can question the projects envisaged regarding these challenges.

Without doing the work for them, PFIs can thus encourage their counterparts to raise questions about their risks, to experiment with solutions and to support them so that they adopt best adaptation practices; for example in terms of initial analysis and vulnerability management, in terms of integrating adaptation into infrastructure asset management[19], and in terms of the strategic and budgetary management of adaptation (I4CE 2020b).

They can help raise awareness and increase skills (for example by encouraging the creation and sharing of sectoral diagnostic and monitoring tools) in networks – of territories or sectors – in which they operate. This proactive attitude can enable PFIs to promote virtuous practices with benefits that extend beyond the duration of their financial commitment to an approach or project.

Beyond this direct dialogue (which can rely only on PFI actors with previous training in these subjects), PFIs can also contribute alongside other actors in the construction of an institutional and economic environment that is conducive to adaptation, for example:

19. In the same way as the Diagnostic de Performance Résilience developed by CDC-habitat with the Mission Risques Naturels to map the vulnerability of its building stock and manage the integration of adaptation work into its maintenance cycles. https://groupe-cdc-habitat.com/actualites/dpr-un-diagnostic-pour-sadapter-aux-changements-climatiques/

• **by jointly organising actions to raise awareness of these issues and to coordinate territorial and sectoral ecosystems** (organising events, publishing guides, facilitating communities of project leaders or entrepreneurs, training…). For example, Bpifrance does this through Le Lab, in which it publishes studies and guides for business leaders[20]; while the CDC's Institut pour la recherche is holding a series of seminars in 2021-2022 on "The challenges of adapting to climate change in the regions"[21]. Another example of this type of action is the i-Nov innovation competition, funded by the State *via* the Programme d'Investissements (PIA) and operated by Bpifrance and ADEME, which has as one of its eight themes of its eighth edition "the adaptation of agriculture to climate change, the management of hazards and the adaptation of territories to climate change."[22].

• **by contributing – financially or intellectually to prospective work at the territorial and sectoral levels.**

• **by participating in the development and dissemination of tools** allowing economic and territorial actors to better appropriate and manage adaptation issues (e.g. vulnerability assessment tools, climate services, management tools).

3. Technical assistance: providing dedicated technical solutions and integrating adaptation into standard services

— While the consulting and technical assistance services of PFIs occupy an important place in the supply, they can also play a driving role in integrating adaptation into the critical moments of the life of assets (project design, renovation or renewal operations, repair following crises).

Generalising the consideration of adaptation in project design phases is essential and requires proactivity on the part of PFIs

— The challenge is to generalise the adaptation of structural projects – planning, infrastructure, economic development projects, etc – on territories. However, an adapted project is above all a project that is well designed in a context of changing climate, i.e. with a design that integrates all the available expertise (choices on orientation, techniques, functions, etc.) on climate change. Expertise and time are needed to properly design a project or strategy according to this criterion:

- **Mobilisation of new skills specific to adaptation** to enable the processing of climate information and the management of adaptation (e.g. use of climate services, proficiency with vulnerability analysis methodologies, etc);

- **Coordination of business skills and time** to take account of the specificities of each context and project; the consequences of climate change can vary significantly from one region to another and, above all, the vulnerability depends on the characteristics of each situation.

The often-multiple options identified lead to changes in the usual ways of doing things and may raise new technical, but also legal and financial issues. Local adaptation strategies, for example, often involve several complementary actions of different types that are spread out over time. Financing such packages by linking different types of expenditure and time horizons can then constitute a real financial engineering challenge for local authorities or SMEs.

The PFI services in technical assistance can be invaluable for addressing these important upstream phases. They provide a way to achieve some of their objectives of supporting economic and territorial actors, while also ensuring the emergence of a flow of fundable projects that meet public policy objectives to which PFIs are required to contribute. Technical assistance is also a key tool that enables PFIs to develop and maintain relationships with their counterparts by being present even before the emergence of projects. To do this, they can rely on their considerable financial and technical capacities, as well as on their extensive experience.

These services are sometimes positioned in response to requests from PFI clients, organising themselves around the requests expressed by these clients. In other examples,

20. See https://lelab.bpifrance.fr and for example the study "Les PME - ETI face aux enjeux climatiques: de la résilience à l'opportunité, les clés du passage à l'action" (2021)

21. See https://www.caissedesdepots.fr/institut-pour-la-recherche

22. This competition aims to support "the accelerated emergence of companies with the potential to become world-class leaders in their field. The winners can benefit from co-financing of their research, development and innovation project." https://www.bpifrance.fr/nos-appels-a-projets-concours/appel-a-projets-concours-dinnovation-i-nov

PFIs can also be proactive by offering their counterparts the opportunity to explore certain themes of interest. For example, such action is being taken by the Banque des Territoires to ensure that consideration is given to priority issues, which are not always considered by communities within the Action Cœur de Ville programme.[23] Given that issues of climate change adaptation are relatively recent, it would appear important to develop this proactive approach, at least during the phase of appropriation of these issues by territorial and economic actors.

Providing dedicated technical assistance solutions and improving conventional solutions

DEDICATED TECHNICAL ASSISTANCE SOLUTIONS

In certain situations, deploying an approach dedicated to adaptation may be relevant, particularly given that climate change constitutes a completely new and potentially strategic subject for an activity or a territory, and that it is necessary to collectively increase competence and to acquire a doctrine and management tools.

Such an approach must rely on the links between a diverse range of skills. It starts with an exploratory phase to provide a better understanding of the vulnerabilities of the studied system (a territory, company, sector, asset, etc.), to analyse the possible consequences of climate change and to identify the priority issues to be addressed. Organising and supporting this work can involve dedicated technical assistance solutions, the mobilisation of specialist adaptation actors as well as thematic expertise depending on the context, and the appointment of a project manager capable of coordinating these components. Such services have started to develop on certain themes – particularly the adaptation of cities with SGREEN and SGREEN+ from Banque des Territoires[24] – and may be relevant to others, for example the adaptation of infrastructure projects; the governance of water resources at territorial scales or changes in flood risk, especially in areas with frequent flooding (CGEDD 2021).

A more cross-cutting approach can also be considered, in the form of support for strategy development for territorial or sectoral resilience to climate change. Such approaches would be particularly relevant for territories or sectors where climate change is a major developing trend – for example in the mountains or on the coast.

ENHANCING CONVENTIONAL TECHNICAL ASSISTANCE SOLUTIONS

In addition to the new and specific technical assistance needs for adaptation, it is necessary to ensure that adaptation is integrated into conventional technical assistance solutions. Of course, not all interventions present the same level of risk and it is important not to complicate the mechanisms unless necessary. However, if teams are given appropriate training, it would seem quite possible to systematically raise the question about whether climate changes are a variable that should be integrated (this could be facilitated by pre-screening tools) at the juncture when the PFI and its counterpart are fine-tuning the definition of its needs at the start of thematic assistance. If necessary, this component could be integrated into the terms of reference of the support project: the requirements could be integrated into the specifications and the support teams could be enhanced to integrate the necessary skills[25]. These requirements, depending on the sector and the maturity of the subjects, could have varying degrees of ambition but remain part of a continuous improvement process. At the very least they should ensure to no longer rely on (obsolete) historical climate assumptions, and encourage the consideration of available climate projections in decision-making – thus promoting the development of increasingly rich regionalised scientific knowledge.[26]

Two points to note: identifying which projects are to be adapted; and aiming to enhance the internal skills of counterparts

THE EMERGENCE OF PROJECTS TO BE ADAPTED MUST BE DETECTED WITH SUFFICIENT NOTICE

Existing feedback has highlighted the importance and difficulty of detecting high-stakes contexts with sufficient notice, and of creating the necessary conditions to ensure that adaptation is properly considered in future critical decisions. For example, EIB experts with responsibility for mobility projects noted that it is very often too late to make adaptations to infrastructure at the point when a bank is asked to support its financing, because decisions on its

23. See https://www.banquedesterritoires.fr/action-coeur-de-ville-ingenierie-territoriale

24. Approximately 20 days of advice, systematically offered to cities that have signed the Action Cœur de Ville conventions to enable them to carry out an analysis of the issues – concerning, for example, the urban heat island effect or the management of rainwater – and operationalise an adaptation strategy – revegetation or permeable surfacing, for example.

25. It should be noted that this systematisation could have the co-benefit of an acceleration in the rise in skills of the various actors and a structuring of the technical assistance supply (currently very heterogeneous) in this area.

26. See (Météo France 2020) or the work of regional expert groups on climate (groupes régionaux d'experts sur le climat – GREC)

design have already been made. In response to this problem, resources can be dedicated to technical assistance missions such as those supported by the JASPERS[27] mechanism within the framework of the implementation of the European cohesion policy helping cities and regions to design more qualitative infrastructure projects. This assistance especially relates to advising local authorities on strategic planning and supporting developers so that projects meet all European standards. It can only be based on the adoption of a proactive stance and local work enabling PFIs to get to know their areas of intervention from this perspective.

AFD'S CROSS-CUTTING ADAPT'ACTION FACILITY

In 2017, the Agence française de développement set up a financing tool with the specific objective to give the 15 countries in which it operates the means to facilitate projects that integrate the challenges of adaptation to climate change and thus contribute to more resilient development. For AFD, Adapt'Action is also a tool for building up a flow of investment opportunities that meet the project criteria that AFD wishes to finance.

The tool has been allocated a budget of 30 million euros over the period 2017-2021 and a support team comprising a lead group and five regional coordinators. It acts by initiating, financing and piloting support projects entrusted to a group of specially selected consulting firms. Such support includes: vulnerability studies, technical assistance or actions to strengthen capacities or structure appropriate governance. The themes addressed by the support projects are very diverse and may concern agriculture and forestry, water, nature-based solutions, climate services, flood management, urban planning, coastal areas and infrastructure, or may involve more cross-cutting issues such as climate and gender, education or health.

As of 1 July 2021, Adapt'Action had committed 83% of its budget to around 75 support projects which had generated more than one billion euros of investments in 26 projects currently in AFD's business plan after having been supported by Adapt'Action (which can therefore be considered as better adapted to climate change). A second phase for 2022-2026 is being prepared.

SUPPORTING THE DEVELOPMENT OF SUSTAINABLE LOCAL EXPERTISE

This action by PFIs, along with that of other technical assistance actors, must support their counterparts in their ability to take long-term ownership of the issue and to develop their skills on the subject. Indeed, strategic choices on economic development and planning can ultimately only result from democratic debates and discussions involving all decision-makers concerned. Moreover, adaptation is rarely a problem solved once and for all, it is an iterative process during which choices – on adjustments or transformations – add up and follow one another as knowledge progresses and as the impacts of climate change materialise. Targeted technical assistance contributions must therefore be designed to initiate discussions, to support the development of local expertise and to ensure that it can be anchored over time.

27. See https://jaspers.eib.org/

4. Banking: specific products, and above all the consideration of adaptation in existing financial services

The financial and patient investor model of PFIs, the types of assets and activities they finance (particularly infrastructure, buildings and networks) and their intervention modes (with for example the capacity to invest in equity) mean that they are well suited to finance adaptation projects and adapted projects.

A few specific products

— In some cases, adaptation funding needs may take the form of specific financial products. This is the case when adaptation brings about new types of projects, activities or actions that do not immediately attract adequate funding.

Our research did not lead us to identify a specific requirement for very distinct financial products that should be structured in an original way to meet adaptation needs. However, certain themes were identified – such as smart irrigation or nature-based solutions – which could be the subject of specially targeted financing to promote their development. Certain products such as the Banque des Territoires's Aquaprêt[28] could already be described as having the central objective of addressing a need linked to adaptation – the efficiency of water networks being a measure of adaptation to the depletion of the resource and changes in flood risk. PFI's could nevertheless explore certain fields to verify that their current services will be able to cover potential emerging needs.

Taking adaptation into account as a criterion integrated into existing financing services

— In most cases, the main challenge appears to be the mainstreaming rationale of adaptation. In other words, the issue is about making the consideration of changing climatic conditions a question that is systematically raised, and thus make adaptation a new co-benefit of the projects and activities financed[29]. The methods of integrating this criterion vary according to **the intervention modes**:

1 **Lending:** the consideration of adaptation could theoretically involve the addition of new indicators reflecting the correlation between the level of adaptation of the asset/activity and the associated financial risk. In practice, this correlation is difficult to establish given the available information and methodologies (I4CE 2018). More realistically, as a first step it would be possible to encourage the implementation and discussion of an assessment of the vulnerability to climate change impacts to be carried out during the preparation of a loan, for example by its financing, potentially linked to the supply of technical assistance, or even – in the long term – as a condition to the granting of a loan. The first option would cost nothing to the counterpart (who remains mainly interested in the loan) but would encourage the initiation of the first stages of an adaptation process, and thus the building up of expertise on the subject[30]. By taking this approach further, it could be worth thinking about the feasibility of adjusting the conditions of the loan to the realisation of adaptation efforts according to the "impact loan" principle: the counterpart receives a loan at a "classic" interest rate which would be subsidised if a certain number of adaptation criteria are met over the duration of the financing.

In the long term, and currently for the most advanced counterparts, additional project adaptation costs can be incorporated into the loan amount. To do this, the counterpart will need to study the impacts of climate change on the project for which the funding request relates, and integrate adaptation measures into its design. To achieve this, a phase for awareness raising and for encouraging and building actor capacity seems necessary, and the proposals for taking charge of vulnerability assessments or "impact loans" could contribute to this transitional phase of taking ownership of the challenges.

2 **Investment and management of strategic participation:** the integration of adaptation can then be considered:

• During the initial stage, in the analysis of investment opportunities – for example by means of sectoral questionnaires for project managers so that counterparts can be systematically questioned on how they are taking climate change into account, to consider the quality of the responses in the analysis of the expected performance, and to enter

28. A loan to modernise drinking water, sanitation, rainwater treatment and flood defence infrastructure with the aim of better preservation and use of water resources in the territory. See https://www.banquedesterritoires.fr/aqua-pret

29. The issue is not the same for all available financial products, some being particularly critical according to the type of action they finance or the sectors concerned. This is particularly the case for all assets and all long-lived activities and all decisions involving a development pathway that is difficult to reverse (and therefore creates lock-in effects).

30. Vulnerability assessments can only be a first step towards adaptation, but they have the advantage of calling upon counterparts on the subject, involving them in a process and objectifying the risks, which is the first step in managing them.

a dialogue with counterparts to reduce the potential risks through adaptation measures to climate change

• Throughout the period when the asset remains in the portfolio, by making adaptation one of the themes that PFI representatives must focus on during their investment monitoring. This focus may take the form of questions asked during board meetings and during investment projects on the asset concerned.

It should be noted that at this stage it is the very fact of asking the question that can provide an incentive for adaptation (by showing that it is a subject of growing interest for investors) and that qualitative evidence may already have significant value (I4CE 2019a).

This generalising of the consideration of climate change and adaptation efforts in project appraisal and financing/investment decisions has a double benefit for PFIs, making them particularly well placed to be a driving force on the subject. By helping to promote adaptation as an objective of public interest, they also serve as prudent financial actor by managing physical climate risks that are particularly significant due to the composition and time frame of their portfolios. Integrating these dimensions into the management of its flows and stocks of assets is therefore playing the role of serving the public interest and the good management of its own risks by ensuring that its assets are ultimately at much lower risk because they are adapted.

THE CASE OF CAISSE DES DÉPÔTS

This role appears particularly critical for an actor like Caisse des Dépôts, which is a shareholder of some of the main organisations able to contribute structurally to the adaptation of French territories. These organisations include many network managers (transport, energy), environmental and urban service operators, developers, donors (especially in social housing) and major tourism actors. It is these organisations that manage their projects and physical assets on a daily basis and can best integrate adaptation into this management.

The role of PFIs towards their subsidiaries and strategic holdings may be in breaking down its strategic adaptation priorities into strategic objectives for its subsidiaries, then to monitor and manage the achievement of these objectives. PFIs can also offer incentives to their subsidiaries in a similar way to their role as investors, by asking questions during board meetings. Finally, they can enable knowledge and skills on the subject to be pooled between its departments and various subsidiaries.

Caisse des Dépôts, as a group, is thus able to combine its financial expertise with the technical and operational expertise of its subsidiaries (CDC habitat, Egis, Transdev, Société forestière, Icade, Compagnie des Alpes, etc.) and its strategic holdings (e.g. RTE, CNR).

5. Specific public mandates: also a role in adaptation

Public mandates

— PFIs can play a role as a public operator with responsibility for specific mandates to implement policies for innovation, acceleration, scaling up or the sustainability of adaptation.

To encourage experimentation but also to support the deployment of resilient models, public authorities can also entrust loans and specific mandates to PFIs, as has been the case with the Programmes d'Investissement d'Avenir – PIA. The PIA supports R&D projects, as well as the development of priority sectors and technologies. While until today, adaptation may have been occasionally or implicitly present in certain actions of previous PIAs[31], it is now more explicit with the PIA4, particularly in the financing of sustainable city demonstrators, with the appearance of criteria that reference it explicitly[32].

Other themes could be the subject of such mandates as public policies mature. These are particularly relevant when the operations concerned involve complex financial arrangements or require the linkage of specialised technical, legal and financial expertise. This could be the case for development projects such as:

- **Renewing coastal** development to address rising sea levels;
- **Tourism, particularly** in mountain regions in the eventual follow-up of current plans (e.g. Avenir Montagnes),
- **Buildings** that better integrate summer comfort issues,
- **Adaptation** of large infrastructure networks,
- **Improving food resilience** by better integrating adaptation into territorial food plans and foresight studies on the future of sectors (ADEME 2019b),
- Etc.

Consignment

— Other skills more specific to certain PFIs can also be mobilised for adaptation, particularly the historic role of Caisse des Dépôts for consignment[33]. Indeed, adapting to climate change will also involve profound transformations. These transformations may take the form of a reorientation of activities and/or relocation of assets to areas with less exposure or vulnerability to climate change impacts. When land, infrastructure or heavy equipment is concerned, reorientation or relocation may prove to be particularly complex and costly. This type of operation will be more feasible and acceptable if it can be anticipated and sequenced in such a way as to avoid disruptions as much as possible and also the concentration of costs within short periods. For example, on the coast where there will be significant need (CGEDD, IGA, and IGF 2019), many proposals have been formulated to consider the gradual dismantling of the ownership of assets that need to be moved, and to start monitoring the land as soon as possible to better design the evolution of the relationship between coasts and adjacent land (Buchou 2020; La Fabrique Ecologique 2019; Lambert 2015). Once decisions have been taken or the outcome is inevitable, it is necessary to ensure that any planned work can be financed when the time comes. For this, compulsory deposit systems can be highly useful by offering a secure means, through a trusted third party, for owners to gradually provide the necessary resources.

This type of device can also facilitate the sequencing of action by authorising temporary usages while ensuring that their completion is well planned. This also contributes to the emergence of economic signals to encourage adaptation (since investments in certain activities or areas are therefore subject to the immobilisation of funds).

There is already provision for a deposit mechanism for use in cases of coastal erosion in Article 242 of the 2021 law on combating climate change and strengthening resilience to its effects[34]. In the areas identified, "when a project requires the issuing of a building permit, a development permit or a decision

31. In particular some of the winning projects of the Territoires d'innovation de grande ambition (TIGA) such as the Smartseille urban island, the Experimental Protocol for a heat island in Lyon, the Littoral+ programme in Occitanie or even certain targeted equity investments, like the one in the UrbanCanopée startup.

32. The specifications of the PIA4 call for expressions of interest "Sustainable city demonstrators" (2021): "The sustainable city demonstrators are in line with the national objectives set by the National Strategy Low-Carbon Strategy (Stratégie nationalee bas-carbone, SNBC) and the National Climate Change Adaptation Plan (Plan national d'adaptation aux changements climatiques, PNACC) and the National Biodiversity Strategy (Stratégie nationale pour la biodiversité, SNVB) [...] The network of demonstrators illustrates combinations of innovative solutions, aiming to meet the four challenges of the sustainable city", among which (2/4) "resilience through the adaptation of cities, their facilities, their organisation and their management in the face of all kinds of risks: extreme weather phenomena aggravated by climate change, geological risk, health crises" https://www.gouvernement.fr/investissements-d-avenir-lancement-d-un-appel-a-manifestation-d-interet-demonstrateurs-de-la-ville

33. "The Caisse des Dépôts et Consignations is responsible for receiving deposits of any kind, in cash or in financial securities, provided for by a legislative or regulatory provision or ordered either by a court decision or by an administrative decision." Art L 518-17 Monetary and Financial Code. See https://www.caissedesdepots.fr/les-consignations

34. See https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043956924

of no objection to a prior declaration, their implementation is subject to […] the deposit made to the Caisse des Dépôts et Consignations of a sum corresponding to the estimated cost of demolition and restoration […] the amount of which is fixed by the town planning authority." This mechanism will be gradually implemented over the next few years.

Similar mechanisms could also be envisaged for other contexts, for example to anticipate the end of activity in a winter sports resort or a farm. For such solutions to be effective, they generally require ad hoc regulatory or legislative changes.

6. Asset and risk management activities

— For PFIs and other financial institutions, asset and risk management professions are also affected by adaptation due to the capacity of adaptation actions to reduce the exposure of PFI counterparts to physical climatic risks. The level of adaptation should therefore be considered in the analysis of the exposure to physical climate risks, carried out at the portfolio or the counterparty level.

The analysis carried out as part of the Finadapter programme focused on the role of PFIs in making a direct contribution to territorial adaptation to climate change. The challenges for asset and risk management activities were not therefore analysed as part of this project. However, previous I4CE work specifically focuses on methodologies for analysing physical climate risks for asset managers and risk management. See in particular: (I4CE 2018; I4CE and CICERO 2021; I4CE 2021b).

In particular, this work shows that "the complex set of sensitivity factors and the adaptive capacities of counterparts can play a crucial role for global physical climate risk. Financial actors may need to understand these factors, to be able to appreciate the robustness of any analytical approach to physical climate risk. Such an understanding can also help them to engage in dialogue with their counterparts on their sensitivity and adaptive capacity, in order to collect data on these subjects and help their counterparts to strengthen their resilience to climate risks" (I4CE and CICERO 2021). This dialogue can be the starting point for PFIs to then be able to offer technical assistance services or additional financing services for adaptation.

IV. PFIs WILL NEED TO DEVELOP THEIR SKILLS, TOOLS AND COORDINATION TO PLAY A FULL ROLE IN ADAPTATION

For PFIs to play a full role in accelerating climate change adaptation they will need to be well organised. In particular, they will need to facilitate skill development among their teams, develop analysis and monitoring tools, and coordinate with each other and with other adaptation actors.

1. Developing the skills of teams

— The ability of PFIs to ask themselves and their counterparts the right questions will be key to their ability to contribute to a positive trend towards adaptation. First of all, this requires their teams to have a general awareness of these subjects, along with familiarisation with climate changes (those we can and cannot anticipate) and with concepts such as climatic hazards, exposure, vulnerability and adaptation capacity (ADEME 2019a). These increases in awareness can only be gradual and collective by involving PFI partners. But it is nonetheless crucial for both technical and sales teams, enabling them to be sufficiently confident to raise the issue with their customers and be able to question them constructively.

Genuine ambition in terms of adaptation will also require more sectoral and thematic knowledge. Indeed, the contextual nature of adaptation means that it depends on a detailed analysis of each situation, on knowledge of territories and intervention sectors, and on the proper coordination of expertise. In this area PFIs have the advantage of being able to mobilise solid sectoral and territorial expertise, to rely on long-lasting networks in the territories and within sectors (notably *via* their regional establishments) and to capitalise on multiple experiences in different places.

Using these assets for adaptation will require the development of more specialised skills from each thematic expert on climate change issues for their field of intervention. It will be necessary to have a good knowledge of foresight exercises (or even to participate directly in them) that fully integrate climate variables (Dépoues 2022), a good understanding of past events and what this can teach us about current and future vulnerabilities, and an active awareness of already trialled adaptation solutions. Finally, there will also be a need for new partnerships and the development of specialist work practices with which PFIs are not yet familiar – for example, partnerships with climate service providers or technical institutes that have developed adaptation expertise.

2. Developing internal analysis and monitoring tools

Various systems can be designed to accelerate this skills development, for example traditional training and support from specialised consultancies or the establishment of an internal expert team to play a support role for the various activities on specific adaptation-related issues. This could also involve establishing a system with human resources and a technical support package dedicated to taking charge of the adaptation of financed projects, with networks as close as possible to counterparts (for example at the level of regional management) (I4CE 2020a). It would then be a matter of supporting the operational PFI teams to identify the challenges and opportunities for adaptation in each intervention context and to support the preparation of adapted projects.

3. Coordination between PFIs and their partners

— PFIs will need to equip themselves to enable adaptation to be considered in each of their activity areas. The consideration of tools is nevertheless already very advanced in many contexts, from which other financial institutions can learn.

PFIs must develop specific methodological tools due to the absence of a reference pathway (adaptation being an iterative process and not a final state), the contextual nature of solutions (a solution is almost never good or bad in absolute terms, but depends on how well suited it is to local factors, the acceptable level of risk and the characteristics of each situation) and the impossibility of applying quantitative and universal metrics (Leiter et al. 2019; EUFIWACC 2016; Hallegatte and Engle 2019).

There are other financial actors operating around the globe that have been working in this field for many years and have already developed methodologies and tools to address the issue. These methodologies are often primarily designed for developing countries and share a logical framework that remains relevant in other contexts. This involves deploying approaches based on process analysis: rather than establishing lists of projects, technologies or sectors that are classed as adaptation in absolute terms, these approaches offer tools for questioning the effectiveness and efficiency of considering climate change in decisions that take each context into account (MDBs, Climate Finance Tracking Working Group, and IDFC 2018; European Commission 2020).

These include:

- **Risk "screening" tools that enable the identification of projects that potentially present significant challenges for adaptation through** a rapid project pre-analysis, for example by analysing the vulnerability of activity sectors concerned and the possible exposure of assets according to their location geography;
- **Guidelines to define operational vulnerability analysis** requirements and provide references for proven analytical methodologies;
- **Guidelines to define requirements for analysing a portfolio's exposure to physical risks** and analytical tools to be used directly by financing teams;
- **Standard questionnaires to help business managers ask** their counterparts about climate risks and adaptation.

PFIs can also benefit from several years of feedback experience from development banks that have practiced these approaches – for example by actively participating in peer-to-peer exchange dynamics such as the Mainstreaming Climate in Financial Institutions initiative[35].

35. Coalition of public and private financial institutions around the world to systematically integrate climate change considerations into their strategies, programmes and operations. https://www.mainstreamingclimate.org/

— Effective PFI adaptation intervention should be based on good coordination with other PFIs and partners. Obstacles to adaptation are often organisational and governance-related, rather than economic or financial. Taking climate change into account is difficult because a great deal of expertise is needed, along with many actors, often without any clear definition of responsibilities (IDDRI 2019; Huitema et al. 2016).

Articulation of technical assistance offers

The technical assistance needs for adaptation are very diverse and depend on the nature of the risks, the extent of the exposure and the project size, and they include: technical assistance for projects to coordinate the integration of adaptation into complex operations; administrative support to apply for assistance or certifications; participation assistance to ensure that many stakeholders are associated in decision-making; regulatory and legal assistance, particularly when it comes to deploying experimental or non-standard solutions; financial engineering to complete the roundtable of projects that link several components and intervention sequences, etc. (Sénat 2020)[36]. Similarly, several organisations are able to provide adaptation support to economic and territorial actors. For example, PFIs, ADEME, ANCT or even CEREMA, as well as regional or more local agencies (such as town planning or economic development agencies) can all support territories and economic actors. The challenge is to ensure that each of these organisations has the necessary internal human resources (which is not necessarily the case for all subjects concerned), that responsibilities are well distributed, and that the services are clear and accessible.

The links between funders and funding sources

Every financial institution has its own intervention priorities and modus operandi – however they also work with the same counterparts as other funders who may also be public funders (local authorities, State agencies, etc.). Good coordination between funders is advantageous for several reasons :

1. **Allowing the financing of adaptation approaches in their entirety:** our previous work (I4CE and Ramboll 2021b) showed that a major difficulty encountered by economic and territorial actors in the implementation of adaptation strategies is the multitude of actions that constitute coherent adaptation pathways. These pathways often bring together different types of action leading to expenditure of different kinds, which can be carried out with different actors, over different time horizons. This situation often means that these actors need to link multiple resources that may have different access criteria and are not always immediately compatible (for example, financing both short-term measures to protect a building exposed to an immediate erosion risk, while simultaneously planning for its long-term relocation). This highlights the importance for funders to coordinate to ensure the complementarity and completeness of their products as well as the compatibility of their criteria.

2. **Pooling the transaction costs of adaptation:** Integrating adaptation into project analysis processes can be time consuming and, in some cases, adds complexity to the process. Specialist expertise is required, which not all funders possess. Coordinating between funders can therefore enable the pooling of analytical skills contributing to the use of criteria and the mobilisation of the most relevant information to guarantee truly adapted projects (a regional directorate for environment planning and housing processing a funding application addressed to the State *via* a PAPI mechanism[37] may, for example, be better placed than a regional directorate of the Banque des Territoires to assess the resilience of a development in a flood-prone area).

3. **Facilitating processes for counterparts and funders.** Responding to adaptation requirements can also be seen as an additional constraint for project leaders in accessing funding *via* processes that are already often regarded as cumbersome. Good coordination between funders along with efforts to make the available public support as clear as possible would help lessen the burden.

36. This Senate report cites the following definition of territorial assistance: "all the professional expertise needed by public authorities and local actors to lead territorial development or sustainable regional planning."

37. The PAPI system (programmes d'actions de prévention des inondations – flood prevention action programmes) is a call for projects led by the State since 2002 to "promote overall management of flood risks at the scale of a coherent risk basin [...]. The programmes are led by local authorities or their groups and constitute the framework of a close partnership [i.e. a financing agreement] with the State in matters of flood prevention." See https://www.ecologie.gouv.fr/prevention-des-inondations#scroll-nav__5

CONCLUSION

PFIs CAN'T DO EVERYTHING

PFIs are well positioned to raise questions about adaptation and to encourage their partners to organise themselves in response to the issue, but are rarely able to assess what would be the best solutions to provide. Indeed, making the best choices in terms of adaptation requires an excellent knowledge of the economic and physical environments in which the activities and assets concerned are located and operated. It is therefore PFI counterparts – whether local authorities or companies – that are most often best placed to implement adaptation and demonstrate the effectiveness of their solutions. These actors have the right visions and business skills to understand and prioritise their vulnerabilities, to compare the available adaptation options and then to report their decisions.

Moreover, the entire financial equation for adaptation will not be resolved through PFI intervention. There is certainly a need for innovation and to experiment to find the best business models for internalising adaptation; there is a need for a maturation stage of the subject, that once reached will hopefully enable a better understanding of the risks and economies of scale, but this alone is not enough. PFIs can be patient, accept a broader definition of investment performance, take on some of the risks[38], but they cannot make viable models out of intrinsically economically unprofitable ones. However, this is the case for certain adaptation actions that nevertheless present a positive socio-economic balance sheet: for example, increasing the robustness of key infrastructure held by monopolies (e.g. transport or energy networks), the rewilding of areas to allow space for water and to minimise flood risks, the dismantling of public facilities and their relocation to areas less exposed to climate hazards. In these cases, adaptation becomes a public issue that can be supported directly by the State, its actors or by local communities.

A SHARED PUBLIC POLICY FRAMEWORK

PFI action would be more efficient and consistent if it was part of a better defined and more ambitious public action framework (Délégation sénatoriale à la prospective 2019; Haut Conseil pour le Climat 2021). Such a framework could define the roles of PFIs more explicitly, and also those of other actors responsible for the implementation of adaptation and its support at each stage. It should also define national priorities and the way in which discussions should be organised, leading to clarity on the collectively acceptable level of risk and the adaptation approaches to be encouraged (I4CE and Terra Nova 2019). Ideally, the action of various actors should be organised around the programming of both investment and operating expenditure that meets adaptation needs. Producing such spending plans for adaptation will however require the immediate commencement of substantive work to better understand and quantify the requirements. It is desirable for PFIs to be associated with and to actively participate in the processes of developing and reviewing the national adaptation plans.

38. Risk sharing appears to be an important lever to facilitate transformations (Canfin and Zaouati 2018)

References

- ACPR. 2021. ***Les principaux résultats de l'exercice pilote climatique 2020***. Analyses et synthèses 122.
- ADEME. 2019a. ***Capacité d'adaptation au changement climatique des entreprises*** ».
- ADEME. 2019b. ***Comment développer sa stratégie d'adaptation au changement climatique à l'échelle d'une filière agroalimentaire ?***
- Baraud- Serfaty, Isabelle, Nicolas Rio, et Clément Fourchy. 2017. ***Qui paiera la ville (de) demain : Étude sur les nouveaux modèles économiques urbains***. Ibicity, Acadie, Espelia.
- Buchou, Stéphane. 2020. ***Quel littoral pour demain ? Vers un nouvel aménagement des territoires côtiers adapté au changement climatique***. Rapport remis à Monsieur le Premier Ministre et à Madame la Ministre de la Transition Écologique et Solidaire.
- Canfin, Pascal, et Philippe Zaouati. 2018. ***Pour la création de France Transition : des mécanismes de partage de risques pour mobiliser 10 milliards d'euros d'investissement privés dans la transition écologique.***
- Carney, Mark. 2020. ***TCFD: strengthening the foundations of sustainable finance.*** In Proceedings of the TCFD Summit,.
- CDC-Biodiversité. 2021. ***Nature en ville aménager aujourd'hui les communes de demain.pdf***.
- CGEDD. 2021. ***Adaptation des territoires aux inondations fréquentes - Actions ou réactions ?***
- CGEDD, IGA, et IGF. 2019. ***Recomposition spatiale des territoires littoraux***.
- COACCH. 2021. ***The Economic Cost of Climate Change in Europe Synthesis Report on State of Knowledge and Key Research Gaps***.
- Cochran, Ian, Romain Hubert, Virginie Marchal, et Robert Youngman. 2014. ***Public Financial Institutions and t he Low-Carbon Transition: Five Case Studies on Low-Carbon Infrastructure and Project Investment***. OECD Environment Working Papers 72. Vol. 72. OECD Environment Working Papers. https://doi.org/10.1787/5jxt3rhpgn9t-en.
- Comité 21. 2020. « ***S'adapter aux changements climatiques : propositions pour une transformation accélérée des territoires et des organisations***.
- Commission Européenne. 2020. ***Rapport final taxonomie européenne par le groupe d'experts auprès de la Commission européenne***.
- Commission européenne. 2021. ***Taxonomie UE - Delegated Act***. juin 2021.
- Délégation sénatoriale à la prospective. 2019. ***Adapter la France aux dérèglements climatiques à l'horizon 2050 : urgence déclarée***.
- Dépoues, Vivian. 2022. ***Quatre usages de l'attitude prospective pour l'adaptation (à paraître)***.
- EIB. 2020. ***EIB Group Climate Bank Roadmap 2021-2025***.
- EUFIWACC. 2016. ***Integrating Climate Change Information and Adaptation in Project Development: Emerging Experience from Practitioners***.
- European Commission. 2021. ***EU Adaptation Strategy***.
- First Street Foundation. 2019. ***Rising Seas Swallow $403 Million in New England Home Values***, 10.
- Fondapol. 2020. ***Les assureurs face au défi climatique***.
- Fretigny, Raphaël. 2015. ***Financer la cité. — La Caisse des dépôts et les politiques de développement urbain en France***. Lyon 2.
- GIEC. 2014. ***Changements climatiques 2014 : Incidences, adaptation et vulnérabilité***. Contribution du Groupe de travail II au cinquième Rapport d'évaluation du Groupe d'experts intergouvernemental sur l'évolution du climat. Genève: GIEC.
- GIEC.2018. ***Rapport Spécial : Réchauffement planétaire de 1,5 °C***.
- Global Commission on Adaptation. 2019. ***Adapt now: A Global Call for Leadership on Climate Resilience***.
- Griffith-Jones, Stephany, Samantha Attridge, et Matthew Gouett. 2020. ***Securing Climate Finance through National Development Banks***. ODI.
- Griffith-Jones, Stephany, et Judith Tyson. 2013. ***The European Investment Bank: Lessons for Developing Countries***. WIDER.
- Group of Multilateral Development Banks. 2020. ***Joint Report on Multilateral development Banks' Climate Finance***.
- Hallegatte, Stéphane, Carter Brandon, Richard Damania, Yunziyi Lang, John Roome, Julie Rozenberg, et Tall Arame. 2018. ***The Economics of (and Obstacles to) Aligning Development and Climate Change Adaptation. A World Bank Group contribution to the Global Commission on Adaptation.***
- Hallegatte, Stéphane, et Nathan L. Engle. 2019. ***The Search for the Perfect Indicator: Reflections on Monitoring and Evaluation of Resilience for Improved Climate Risk Management***. Climate Risk Management 23: 1-6. https://doi.org/10.1016/j.crm.2018.12.001.
- Haut Conseil pour le Climat. 2021. ***Rapport annuel 2021***.

- Hayez, Stéphane, et Frédérique Savel. 2018. ***Bpifrance : entreprises et territoires***. Revue d'économie financière N° 132 (4): 179. https://doi.org/10.3917/ecofi.132.0179.
- Heuson, Clemens, Erik Gawel, et Paul Lehmann. 2014. ***State of the Art on Economics of Adaptation***. In Routledge handbook of the economics of climate change adaptation., Routledge.
- Huitema, Dave, William Neil Adger, Frans Berkhout, Eric Massey, Daniel Mazmanian, Stefania Munaretto, Ryan Plummer, et Catrien C. J. A. M. Termeer. 2016. ***The Governance of Adaptation: Choices, Reasons, and Effects. Introduction to the Special Feature***. Ecology and Society 21 (3): art37. https://doi.org/10.5751/ES-08797-210337.
- I4CE. 2015. ***Lessons from the use of climate-related decision-making standards and tools by DFIs to facilitate the transition to a low-carbon, climate-resilient future***.
- I4CE. 2018. ***Se lancer dans l'analyse de risques climatiques physiques en finance***.
- I4CE. 2019a. ***Pour une autre approche du risque climatique en finance – Tenir pleinement compte des incertitudes***.
- I4CE. 2019b. ***Un cadre pour l'Alignement avec l'Accord de Paris : Pourquoi, quoi et comment pour les institutions financières ?***
- I4CE. 2020a. ***Des Plateformes régionales pour l'adaptation. I4CE (blog). 2020. https://www.i4ce.org/download/plateformes-regionales-pour-ladaptation-climat/.***
- I4CE. 2020b. ***Évaluation climat des budgets des collectivités territoriales – Volet adaptation***.
- I4CE. 2021a. ***Pas d'adaptation sans exigences opérationnelles ni moyens humains***.
- I4CE. 2021b. ***Taking climate-related disclosure to the next level - Minimum requirements for financial institutions***.
- I4CE, et CICERO. 2021. ***Relever les défis de l'analyse du risque climatique physique en finance***.
- I4CE, et Ramboll. 2020. ***Territoires : les chantiers de l'adaptation. Projet Finadapter.*** 2020.
- I4CE, et Ramboll. 2021a. ***Défis rencontrés par 5 démarches territoriales qui cherchent à être à la hauteur des enjeux d'adaptation***.
- I4CE, et Ramboll. 2021b. ***Les défis économiques pour généraliser la prise en compte de l'adaptation au changement climatique dans les territoires français***.
- I4CE, et Terra Nova. 2019. ***Adaptation au changement climatique : comment passer à la vitesse supérieure ?***
- IDDRI. 2019. ***L'adaptation au changement climatique en France : focus sur le cadre national***.
- IDFC. 2015. ***Common Principles for Climate Change Adaptation Finance Tracking***.
- IDFC. 2018. ***Lessons Learned from Three Years of Implementing the MDB-IDFC Common Principles for Climate Change Adaptation Finance Tracking***.
- IDFC. 2020. ***IDFC Green Finance Mapping Report 2020***. https://www.idfc.org/wp-content/uploads/2020/11/idfc-2020-gfm-full-report_final-1.pdf.
- IPCC. 2021. ***6th Assessment Reports. Climate Change 2021: The Physical Science Basis***.
- Kates, R. W., W. R. Travis, et T. J. Wilbanks. 2012. ***Transformational Adaptation When Incremental Adaptations to Climate Change Are Insufficient***. Proceedings of the National Academy of Sciences 109 (19): 7156-61. https://doi.org/10.1073/pnas.1115521109.
- La Fabrique Ecologique. 2019. ***L'adaptation au changement climatique sur le littoral français***.
- Lambert, Marie-Laure. 2015. ***Le recul stratégique : de l'anticipation nécessaire aux innovations juridiques***. VertigO, no Hors-série 21 (avril). https://doi.org/10.4000/vertigo.15812.
- Leiter, Timo, Anne Olhoff, Rima Al Azar, Vicki Barmby, et Dennis Bours. 2019. ***Adaptation Metrics: Current Landscape and Evolving Practices***. Background papers. Global Commission on Adaptation.
- Macfarlane, Laurie, et Mariana Mazzucato. 2018. ***State Investment Banks and Patient Finance: An International Comparison: Policy Report***. IIPP.
- Magnan, Alexandre, Ariadna Anisimov, Alexandra Deprez, et Sébastien Treyer. 2020. ***L'adaptation au changement climatique après l'Accord de Paris sur le climat : un renforcement au niveau mondial, mais des défis politiques et scientifiques à relever***. IDDRI (blog). 24 novembre 2020.
- McAlpine, Steven A., et Jeremy R. Porter. 2018. ***Estimating Recent Local Impacts of Sea-Level Rise on Current Real-Estate Losses: A Housing Market Case Study in Miami-Dade, Florida***. Population Research and Policy Review 37 (6): 871-95. https://doi.org/10.1007/s11113-018-9473-5.
- MDBs, Climate Finance Tracking Working Group, et IDFC. 2018. ***Lessons learned from three years of implementing the MDB-IDFC common principles for climate change adaptation finance tracking***.
- Mees, Heleen L.P., Peter P.J. Driessen, et Hens A.C. Runhaar. 2012. ***Exploring the Scope of Public and Private Responsibilities for Climate Adaptation***. Journal of Environmental Policy & Planning 14 (3): 305-30. https://doi.org/10.1080/1523908X.2012.707407.

- Météo France. 2020. ***Les nouvelles projections climatiques de référence DRIAS 2020 pour la métropole***. http://www.drias-climat.fr/document/rapport-DRIAS-2020-red3-2.pdf.
- Mogelgaard, Kathleen, Heather McGray, et Niranjali Manel Amerasinghe. 2015. ***What Does the Paris Agreement Mean for Climate Resilience and Adaptation?*** WRI (blog). 23 décembre 2015.
- Mountain Wildernes. 2018. ***Les installations obsolètes : Aménagements abandonnés en montagne***.
- Mullan, Michael, et Nicola Ranger. 2021. ***Towards adaptation-aligned finance. Climate-resilient Finance and Investment***. OECD Framing Paper. Collaboration between the OECD and the UK Centre for Greening Finance and Investment.
- OECD. 2008. Aspects économiques de l'adaptation au changement climatique: coûts, bénéfices et instruments économiques. Paris: Editions OCDE.
- OECD. 2015. ***Climate Change Risks and Adaptation : Linking Policy and Economics***,. Paris.
- ONERC, éd. 2012. Les outre-mer face au défi du changement climatique: rapport au Premier ministre et au Parlement. Paris: la Documentation française.
- ONERC, 2019. ***Des solutions fondées sur la nature pour s'adapter au changement climatique. Rapport au Premier ministre et au Parlement***. MTES.
- Perthuis, Christian de, Stéphane Hallegatte, et Franck Lecocq. 2010. ***Économie de l'adaptation au changement climatique***, 90.
- Plihon, Dominique, et Sandra Rigot. 2021. ***Les intermédiaires financiers publics : un nouveau modèle de financement pour la transition énergétique ?*** Revue Economique (soumission), 2021.
- Sainz de Murieta, Elisa, Ibon Galarraga, et Anil Markandya. 2014. ***Introduction to the economics of adaptation to climate change***. In Routledge handbook of the economics of climate change adaptation., Routledge.
- Schneider, Tina. 2014. ***Responsibility for Private Sector Adaptation to Climate Change***. Ecology and Society 19 (2): art8. https://doi.org/10.5751/ES-06282-190208.
- Sénat. 2020. ***Rapport d'information fait au nom de la délégation aux collectivités territoriales et à la décentralisation sur l'ingénierie territoriale et l'agence nationale de la cohésion des territoires,***.
- Simonet, Guillaume. 2020. ***De l'ajustement à la transformation : vers un essor de l'adaptation ?*** Développement durable et territoires, no Vol. 11, n°2 (juillet). https://doi.org/10.4000/developpementdurable.17511.
- Thiveaud, Frédéric. 2016. La Caisse des dépôts. Que-sais-je?, n°3835. Paris: PUF.
- Tompkins, Emma L., et Hallie Eakin. 2012. ***Managing Private and Public Adaptation to Climate Change***. Global Environmental Change 22 (1): 3-11. https://doi.org/10.1016/j.gloenvcha.2011.09.010.

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