D5.1 – Synthesis of barriers and solutions for Adaptation Finance

WP5 – Task 5.1

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Funded by the European Union

Disclaimer

Acknowledgements

The authors are grateful for the many comments, insights, expertise, contributions, and support provided by individuals. We wish to thank:

Name	Institution
Kit England	Paul Watkiss Associates
Oscar Higuera-Roa	IIASA
Mariana Corvaro	Regions4

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Document information

Grant Agreement	n°101093942
Project Title	Pathways2Resilience
Project Acronym	P2R
Project Coordinator	Thomas Koetz, EIT Climate-KIC
Project Duration	01 January 2023 – 31 December 2027 (60 months)
Related Work Package	5
Related Task(s)	5.1
Lead Organisation	AUEB
Contributing Partner(s)	PWA, GIB, IIASA, IIED Europe, ICLEI, KCIC
Due Date	31.03.2024
Submission Date	30.06.2024
Dissemination level	Confidential

History

Date	Version	Submitted by	Reviewed by	Comments
15.09.23	1	Kostas Dellis	Phoebe Koundouri	Draft for circulation
03.11.23	2	Kostas Dellis	Phoebe Koundouri	Draft for circulation
06.03.24	3	Kostas Dellis	Phoebe Koundouri	Internal assessment
26.04.24	4	Kostas Dellis	Mariana Terreros	Quality Review
29.05.24	5	Kostas Dellis	Olivier Fauchet	Quality Review
15.06.24	6	Kostas Dellis	Olivier Fauchet	Formatting review

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Summary

Introduction

The increasing impacts of the climate crisis are felt both within Europe and globally. Addressing these impacts necessitates an understanding of how climate change brings about new risks or amplifies existing ones and implementing strategies to manage these risks. Financing the green transition is a basic tenet of sustainable transformation and climate finance has gained traction in the EU and global scale. Public and private funds funneled to climate change have increased but still need to be substantially scaled up to meet global needs. Adaptation finance is lagging mitigation finance by a margin, although it has been identified as one of the Key Enabling Conditions by the EU in the Mission Adaptation. EU regions need to overcome sizeable barriers to attract financial resources for adaptation projects and lack the capacity to leverage scarce resources and finance bankable adaptation projects. Having said that, an array of tools and services exist to help regional actors develop their adaptation finance strategy and attenuate the strength of these barriers. Pinpointing the barriers to adaptation finance and documenting the facilities available for EU regions to transform is, hence, material in promoting the Mission Adaptation objectives.

The objective of this report, shaped as a Deliverable for the Pathways to Resilience (P2R) project, is to develop the classification and assessment of the key barriers facing regions for securing and harnessing climate adaptation finance and to outlines the solution mechanisms in the EU ecosystem in the form of accelerators, fintech and project preparation facilities. Moreover, it documents data and trends pertaining to key variables identified in the process. In addition, the report identifies active solutions for regional adaptation finance in the form of accelerators, project preparation facilities, knowledge platforms and fintech solutions. Specifically, barriers and solutions are analysed with direct reference to the Mission Adaptation Key Community Systems (KCS). Finally, we undertake a first attempt to map financial solutions to specific barriers facing EU regions.

In doing so, the report contributes to the regional benchmarking exercise for the P2R process of the Regional Resilience Journey (RRJ) and empowers the P2R Consortium in bridging the gap between regional needs and financial solutions for bankable adaptation projects. The report, representing Deliverable 5.1 of the project revolves around the following key pillars:

- **A categorization of the main barriers to Adaptation Financ**e for regions as highlighted in the relevant academic and grey literature
- An assessment of the barriers concerning their **relevance to transformational adaptation projects**
- The identification of barriers that hinder the design and implementation of **bankable adaptation projects**
- The manifestation of the barriers in the **Key Community Systems (KCS)**
- The understanding of r**egional structural attributes as implicit barriers for adaptation finance** following an Economic Geography perspective
- **The catalogue of solutions for regional adaptation finance**
- The mapping of financial solutions to specific barriers
- The assessment of suitability of available solutions for distinct KCS

Overall, the report outlines a strategic framework to enable regional authorities in navigating the complex landscape of adaptation finance, by emphasizing the need for a tailored approach to match financial solutions with specific regional needs and barriers. This framework advocates

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for a deeper engagement between regional stakeholders and financial institutions to co-design effective adaptation strategies that are both impactful and bankable. By promoting a better understanding of the economic geography and structural characteristics of regions, the report provides a blueprint for integrating climate adaptation finance into broader regional development plans.

Barriers for Adaptation Finance

According to the latest IPCC Synthesis Report (2023), there are sizable barriers to climate change adaptation finance resulting in underinvestment among growing global needs. They vary in terms of frequency and salience depending on the sector financing adaptation projects (public or private), the sector carrying out adaptation projects, the type of adaptation (reactive or anticipatory), and the ambition of adaptation projects (incremental or transformational). In this report we classify these barriers into five broad categories following a synthetic approach of the relevant literature as follows:

1. economic and market barriers
2. socio-cultural and behavioral barriers
3. knowledge and awareness barriers
4. technological barriers
5. political and institutional barriers.

All barriers are assessed in relation to their manifestation in the access to scarce financial resources as well as the transformation of funding to bankable adaptation projects with maximum impact for the regional adaptation targets.

Solutions for Adaptation Finance

Regions require assistance to address the barriers to adaptation finance, foster capacity building, and design and implement adaptation investment plans that yield bankable adaptation projects. At the core of any adaptation plan lies the identification and assessment of diverse financial sources and setting the groundwork for securing and harnessing funding. Having said that, transformational adaptation warrants support from innovative financial mechanisms, an area where regions are stifled by barriers such as lack of awareness and technical skills. Smarter adaptation requires smarter adaptation finance, which encompasses innovative instruments, embraces financial technology (fintech) and, above all, is based on cooperation and private-public initiatives (EIB, 2021). This report explores an array of financial solutions designed to support climate adaptation, categorized into Technical Assistance, Accelerators, Project Preparation Facilities, and Fintech Solutions. These categories encompass a diverse landscape of initiatives and organizations, ranging from investor-led platforms and public-private partnerships to specialized advisory hubs and financial inclusion think tanks. Collectively, they illustrate the multifaceted nature of financial mechanisms available for climate adaptation, each contributing in unique ways to advance both technological and social dimensions of sustainability. In the vast landscape of climate adaptation support services, this section of the report focuses on the specific tools that are earmarked to empower regional authorities in raising and harnessing financial resources for adaptation initiatives.

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Conclusion

Despite the coordinated efforts from government, international institutions, industry, and the research community, global adaptation finance flows account for less than 5% of climate financial flows. Underscoring and categorizing the regional barriers for adaptation finance (attracting and efficiently using financial resources) and linking them to the available financial solutions for EU regions is particularly important for ramping up the resources and the efficiency of climate adaptation.

This report provides a thorough review of the literature regarding adaptation finance barriers and complements them with a reference to the underlying trends for EU regions. Barriers can manifest in many spheres of activity, either as impediments to securing financial resources or through thwarting regions' capacity to adapt and transform. The data indicates that there is substantial intra-EU divergence associated with the prevalence of specific barriers and the enabling conditions to design and implement bankable adaptation projects. Regarding transformational adaptation, we highlight the importance of cross-sectoral cooperation deficiencies, inadequate (or absent) regional innovation systems and lack of political as the biggest impediments.

The report also outlines adaptation finance solutions, including several online platforms for technical assistance, knowledge repositories, innovation accelerators, marketplaces and fintech solutions. In addition, it attempts to link them to the relevant adaptation finance barriers so that regions can benefit from the services provided by facilitators and platforms by accessing the tools most pertinent to their needs. Project Preparation Facilities cater to economic and market barriers, green accelerators are an especially useful resource for addressing technological barriers, while platforms offering technical assistance exhibit moderate to high relevance to all types of barriers, especially contributing to raising knowledge and awareness.

Financing for adaptation is a building block of the RRJ manifesting throughout the process. This report, combined with the catalogue of financial instruments, the regional attributes stemming from the regional self-assessment procedure and the workings of the Private Finance Expert Group (PFEG) aims to bolster regions' efforts to design, implement and monitor bankable adaptation projects and contribute to the sustainable transformation of the EU as envision by the EU Green Deal.

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Keywords

Adaptation, finance, funding, Key Community Systems, Finance Barriers, funding sources, financing instruments, structuring, Adaptation Finance Process, Accelerators, Project Preparation Facilities, Regional Development

Abbreviations and acronyms

Term	Definition
WP	Work Package
RRJ	Regional Resilience Journey
RAST	Regional Adaptation Support Tool
RMC	Resilience Maturity Curve
KCS	Key Community Systems
EIB	European Investment Bank
NUTS	Nomenclature of Territorial Units for Statistics
IPCC	International Panel for Climate Change
OECD	Organization for Economic Co-operation and Development
R&D	Research and Development
NbS	Nature-based Solutions

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1 Introduction

The increasing impacts of the climate crisis are felt both within Europe and globally. Addressing these impacts necessitates an understanding of how climate change brings about new risks or amplifies existing ones and implementing strategies to manage these risks. Over recent years, there has been a rise in global climate finance flows. However, as outlined by the IPCC (2023), the funds dedicated to achieving net-zero targets still fall significantly short, with the latest estimate pointing to an increase in climate investment by 3-6 times the current levels. Notably, most of the existing financial resources have been channelled towards mitigation efforts, with a mere US$46 billion allocated for adaptation, primarily from public coffers. There is a growing consensus on the need to increase both public and private finance dedicated to adaptation to bridge this financial gap. There is a growing need for international actors in the field of climate to adapt and evolve the financial products and solutions at hand to funnel funds towards bankable and efficient adaptation projects (OECD, 2023). Nonetheless, global adaptation finance dropped by 4 billion $ (14% year-on-year) in 2021, resulting in a decrease in its share of total climate finance from 34% to 27%. International stakeholders agreed in the 2023 COP in Dubai to establish large-scale financing mechanisms to triple clean energy investment in emerging and developing economies. Moreover, all parties agreed that finance is the key enabling condition to usher in a green transition at the local and global level. However, current global financing commitments are still far below the $160 billion to $340 billion required annually by 2030 according to U.N. estimates[1].

The EU Mission on Adaptation to Climate Change champions the cause of European regions, cities, and local authorities in bolstering resilience against climate-related dangers. The overarching aim is to guide and support over 150 European regions and communities in their journey to achieve climate resilience by 2030.

The Pathways2Resilience (P2R) initiative aligns with the objectives of the Mission and the Adaptation Strategy, enabling regions to:

- better understand their climate risks.
- develop their pathways to be better prepared and cope with the changing climate
- evaluate and deploy innovative solutions needed to build resilience.

Work Package 5 of P2R project is devoted to the understanding of the systemic factors influencing adaptation financing and one of its objectives is to help regions and key stakeholders to clearly understand the main factors that influence Adaptation Finance. The purpose is to define and assess barriers for adaptation finance both in terms of attracting the necessary financial resources and of harnessing funds for efficient adaptation projects. This encompasses a comprehensive literature review on barriers to adaptation finance, collating insights on the challenges and solutions in adaptation finance, as well as documenting statistical data on European regions (NUTS2 level) regarding measurable financial barriers and capacity building.

Drawing from extensive scientific papers, reports, and journals, this review thoroughly explores the barriers in the adaptation finance arena. By focusing on literature primarily from European

[1] https://www.unep.org/news-and-stories/press-release/global-annual-finance-flows-7-trillion-fueling-climate-biodiversity

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and other nations, this review ensures the relevance of its findings to the communities and regions P2R aims to assist. The literature review adopts a systematic methodology, utilizing premier academic databases and maintaining stringent criteria for paper selection. This ensures the research is comprehensive, relevant, and draws on recent publications, offering the most accurate and up-to-date insights into the field of climate adaptation finance.

The task is of material importance in the project as it establishes the baseline for the resource mobilization process and contributes to the first step of the Regional Resilience Journey (RRJ), namely "Prepare the Ground" through providing initial information on the state of regional competences (on the field of finance) and through mapping the system of regional stakeholders in the topic. Finally, the findings of this report are of direct connection to the regional input collected during the Expression of Interest (EoI) process (WP2), the Call for Regional Participation (WP3) and the self-assessment exercise conducted by the regions for the Resilience Maturity Curve (WP1).

This report purports to present a thorough synthesis of the collected literature on barriers of adaptation finance, shedding light on current finance practices, identifying gaps, and proposing actionable solutions to align financial strategies with climate adaptation goals.

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2 Background

2.1 State of Climate Adaptation Finance

According to the IPCC AR6 (2023) among the main barriers to adaptation are limited resources, lack of private sector and citizen engagement, insufficient mobilization of finance (including for research), low climate literacy, lack of political commitment, limited research and/or slow and low uptake of adaptation science, and low sense of urgency. Having said that, the issue of maladaptation holds significant weight in the climate change adaptation process. Adverse climate impacts not only result in losses and damages but also impede national economic growth, thus diminishing the availability of financial resources, particularly for developing and least developed countries. More specifically, in the field of adaptation finance the report underscores the persistence of barriers within and outside the financial sector.

Channelling financial resources towards climate adaptation across the globe, and specifically to vulnerable and ill-equipped regions and communities is of pivotal importance. Despite the acceleration of climate change and increase in the frequency and severity of extreme phenomena, the adaptation gap -The difference between implemented adaptation and a societally set goal- is widening, estimated between US$194 billion and US$366 billion per year (UNEP, 2203). Global funds for climate adaptation stood at 63 billion in 2022 (CPI, 2023) compared to 1.15 trillion USD to mitigation actions. In addition, the largest share of funding stems from public resources, through the form of grants or derisking private sector projects. The financing gap is more pronounced in the case of developing economies. It is estimated that "the adaptation finance needs of developing countries are 10-18 times as great as international public finance flows – over 50 per cent higher than the previous estimated range" (UNEP, 2023).

Regarding the EU, Climate Adaptation is a tenet for sustainable transformation by mid-century, highlighted by the Mission Adaptation. The Missions aims at supporting at least 150 European regions to become climate resilient by 2030 and runs in parallel with the EU Adaptation Strategy with the overarching goal of a climate resilient Europe by 2050. As of late 2023,308 regional and local authorities have signed the Mission Charter since the Mission launch in 2021, demonstrating a clear political commitment to work towards the Mission's objectives. The new EU Strategy on Adaptation updated in 2021 is an integral part of the European Green Deal and the European Climate Law and constitutes an ambitious upgrade of the 2013 EU Adaptation Strategy and sets ambitious targets on the region's adaptive capacity in line with the Paris Agreement. Acknowledging the pivotal role of finance in the Mission implementation, the EC with the support of the European Investment Bank (EIB) has focused on developing bankable adaptation projects with the active cooperation of EU regions. In 2023 EIB invested 44.3 billion euros (directly or indirectly) in climate action, representing 60% of total investments.

The barriers associated with the functioning of financial markets at the regional (sub-national), national and international level include underestimation of climate-related risks and poor evaluation of investment opportunities and their long-term impact; regional mismatch in financial markets between available capital and investment needs, home bias factors, country economic distress, and limited institutional development. Moreover, outside the traditional financial sector, adaptation finance barriers entail underdeveloped capital markets; unattractive risk-return profiles, lack of scientific knowledge to ensure standardization, aggregation, scalability and replicability of investment opportunities and inadequate local and national

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innovation systems to foster transformative and successful adaptation projects. Insofar as transformative climate adaptation is fundamentally linked to innovation, access to finance is of central importance given the increased externalities associated with green innovation (Popp et al., 2010). A recent survey by the EIB (2023b) finds that 66% of European start-ups that under-invested in climate innovation in the last three years, and 53% of established firms respectively, state that the availability of finance is a major obstacle.

Expanding the objectives of the EU Mission on Adaptation to Climate Change, the Pathways2Resilience program will guide European regions and communities, through a collaborative effort. This involves the creation of customized pathways leading to a climate-adaptive future, offering guidance that aligns to local needs. By harnessing diverse knowledge and learning, P2R enables 100 regions to advance climate resilience through the development of context-specific adaptation pathways and the enhancement of their transformative capacity. The overarching goal of all involved stakeholders is to co-design, implement and monitor an inclusive journey inspiring regions in Europe and beyond.

2.2 Position in P2R

Work Package 5 (WP5) entitled "Support Services to bridge the Adaptation Finance Gap" contributes to the RRJ through the identification of systemic barriers to adaptation finance and a data-based catalogue of financial solutions for regions, focusing on innovative financial mechanisms. A synthesis of these two strands of work within P2R will result in a data-driven approach for tailor-made financial solutions according to regional needs and capacities. The main body of the work carried out in WP5 includes:

- Mapping systemic barriers to financing, synthesis lessons and identify solutions against the regional needs for adaptation finance
- Creating a data-based catalogue of finance mechanisms, sources, and best practices (Development and National Banks at the macro level, national public and private investment and insurance organisations at the meso level) and developing a process for building adaptation finance strategies and resource mobilisation plans.
- Developing an Adaptation Finance capacity package that is a region-tailored set of material (as an input to WP7 in the form of action-orientated online tools and catalogues, training material).
- Support the activities in WP7 on adaptation finance strategies and resource mobilisation plans, and to provide tailored one-to-one support with several regions.
- Developing an Adaptation Finance Innovation Lab to design and conceptualizing innovative finance mechanisms and business models tailored to regions as well as propose and advise regions on adaptation finance and innovation policy

Furthermore, the work will be bolstered by the creation of a Practitioner Finance Expert Group (PFEG) aimed at informing P2R members of relevant, new, and innovative financial solutions, raising awareness over regional investment plans, and facilitating discussions on matchmaking between public and private investors and project proposers within the P2R cohort.

Overall, the P2R consortium (and WP5 partners in particular) aims to co-design concise adaptation investment plans with regions and define key steps in the adaptation finance process.

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Within the context of the P2R project, this report describes the work undertaken in WP5, specifically Task 5.1 which aims to:

1. Cross-map and synthesize systemic barriers to adaptation finance for European regions
2. Identify solutions to overcome the aforementioned barriers, against different adaptation solutions for the Mission KCS.
3. Review barriers and solutions for adaptation in the context of macro-fiscal policy and economics and the implications of adaptation on regional public finances
4. Map applicable solutions to specific barriers to ensure compatibility in regions' adaptation plans
5. Establish needs and demand from the regions engaged in PEERS for adaptation finance support

The report does not underscore generic barriers to Adaptation, as this is addressed by the design and co-creation with regions of the RRJ developed in WP4 and WP6. Insofar as financial constraints are ubiquitously considered a substantial hindrance to the adaptation process, the aim of this report is to highlight the reasons regions face limited access to financial resources and fail to capitalize on existing funds from whichever source. To this end, we consider both barriers as well as constrained capabilities which hinder the two phases of adaptation finance described above. We specifically underline the regional (and national) capacities as material to the adaptation finance and overall adaptation process in order to stress the holistic nature of the issue and the need to mobilize all sectors and stakeholders in the region. Moreover, where applicable, we identify the manifestation of each barrier at different spatial levels (regional, national, international) and the type of adaptation they constrain (incremental or transformational).

The findings of this report will inform the Regional Adaptation Finance Support System Guide (D5.3) and will be an intrinsic part of the Online toolbox of adaptation finance and capacity training modules (D5.4). Furthermore, it will act as complementary to the regional profiles identified in D1.3 in an effort to cross-fertilize key findings from the literature and regional official data with the regions' perspective on their most pressing barriers for adaptation finance. This report is closely interlinked with the adaptation finance catalogue developed in detail in D5.2 to map financial sources, instruments, and intermediate institutions (Accelerators, PPFs, Adaptation Platforms) with the idiosyncratic barriers facing EU regions. Finally, the report on barriers and solutions for adaptation finance will inform the Online toolbox of planning and evaluation developed as part of D6.6 and D6.8.

2.3 Position in the Regional Resilience Journey

Task 5.1 and the output of this report are of pivotal importance for the P2R approach for regions. The comprehensive approach is reflected in the Regional Resilience Journey (RRJ) which guides regional authorities and materializes the co-creation process from the initial stage of establishing the baseline until the dissemination of bankable projects and scalability of adaptation investment plans. Identifying, classifying, and evaluating the barriers associated with adaptation finance are integral parts of the first stage of the RRJ – Preparing the Ground. More specifically, as shown in Figure 1, this activity serves as a salient step in gathering the evidence base, which is the initial step in the adaptation investment process. The work described in this report provides initial information on the state of regional competences under a multi-layered approach to cover all aspects contingent to attraction and leveraging of financial resources. Moreover, characterizing the solutions landscape for adaptation finance and cross-referencing

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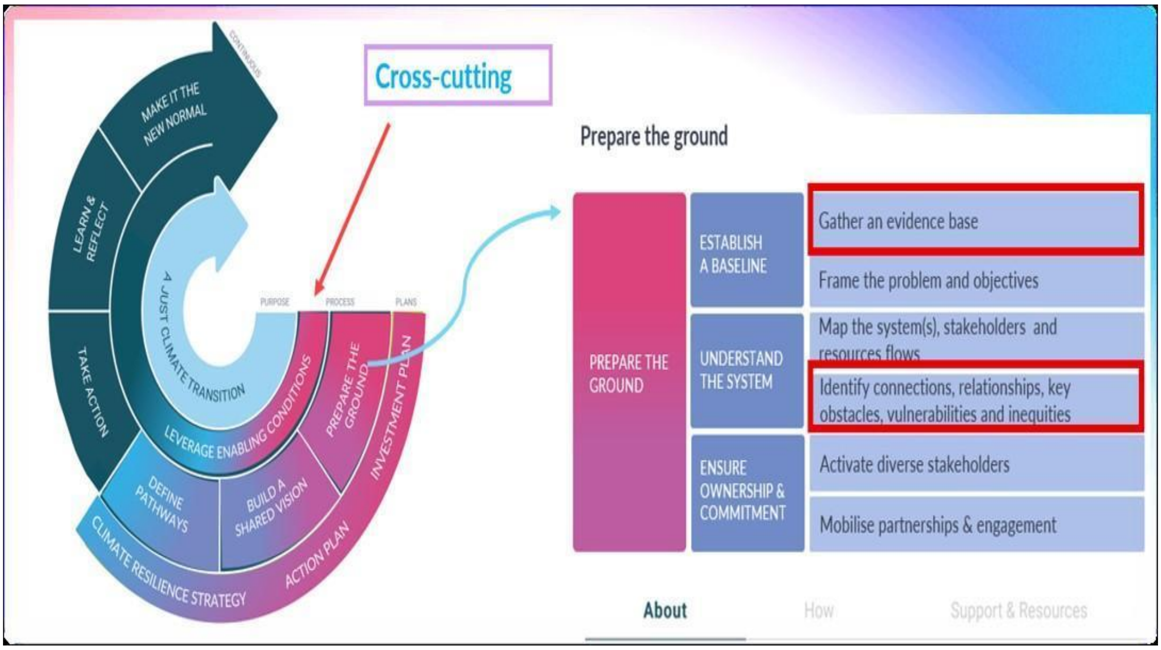
with the list of financial barriers contributes to identifying connections and relationships in the second pillar of the first phase of the RRJ (Understanding the System).

Figure 1: Position in the RRJ



Source: P2R & Authors' Elaborations

2.4 Position in the Adaptation Investment Cycle

A seminal contribution of Pathways to Resilience and specifically WP5 is the development of the Adaptation Investment Cycle (AIC) for regions. It is an iterative, six-step process designed to be undertaken in parallel to the development of a regions' Climate Resilience Strategy through Pathways2Resilience's Regional Resilience Journey, or as a separate standalone process for regions which have already developed Adaptation Strategies. The process is intended to guide and learn from regions in the creation and implementation of transformational adaptation projects.

As can be inferred by the concrete steps depicted in Figure XX, the work described in this report is an integral part of addressing specific financial barriers (Step 2) and defining investment needs and strategies. More specifically, the classification, characterization, and assessment of barriers for adaptation finance helps define the investment context for the region in Step 2, including the level of capacity measured by a broad range of indicators. Collating financial solutions in the form of support mechanisms and mapping them to the specific identified barriers also contributes to Step 2 (2.2 and 2.3). Furthermore, the bevy of solutions analyzed here are a material part of Step 3.2, whereby investment strategies are developed.

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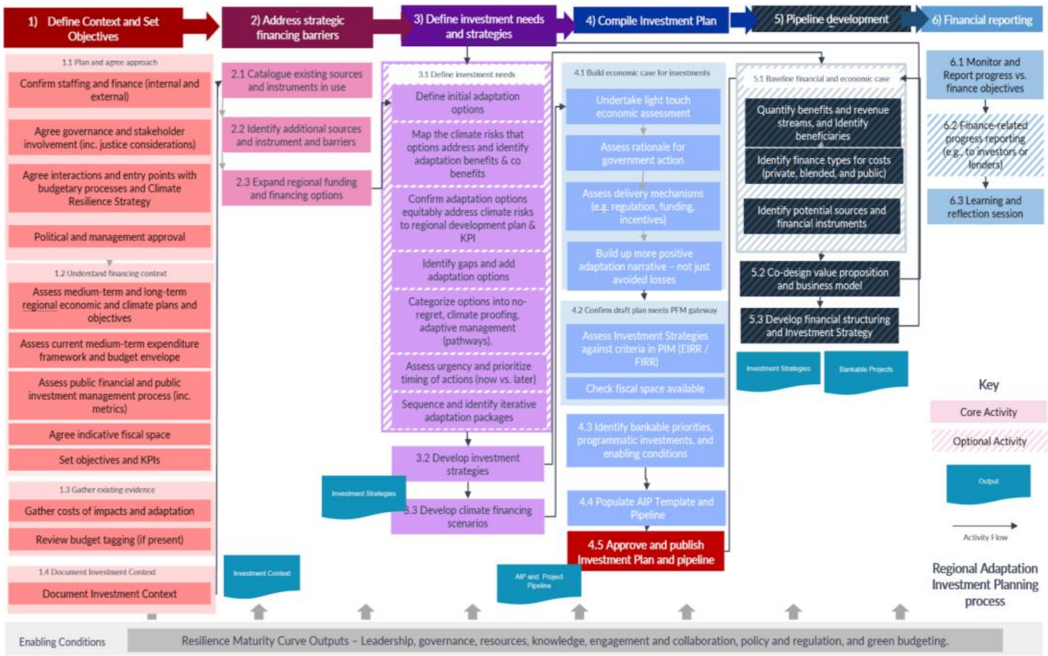
Figure 2: The P2R Adaptation Investment Cycle



Source: Pathways to Resilience (forthcoming)

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3 Methodology of Reviewed Studies

3.1 Literature Collection Process

To ensure a comprehensive and accurate analysis of the ongoing projects, we relied upon scientifically recognized papers and reports. Our primary sources were reputable journals and databases that are recognized for their credibility in the academic and scientific community. The databases we consulted include Google Scholar, Semantic Scholar, Elsevier Scopus, and Web of Science.

To maintain relevance to the projects' scope, the literature review specifically targeted papers and reports from European and other developed countries. These studies were selected based on their contextual similarities to the regions and communities anticipated to be part of our ongoing project.

The search was performed using specific terms such as "Climate change adaptation", "Barriers", "Urban adaptation", "Obstacles", "Climate Finance", and "Adaptation strategies". These terms were used both independently and in combinations to maximize the range of relevant literature. An emphasis was placed on more contemporary literature, favoring papers published within the last 15 years, starting from 2007. Furthermore, to ensure consistent comprehension across the team and to cater to our primary audience, only papers written in English were considered.

3.2 Data Elicitation from Selected Studies

Once the relevant studies were collated, a structured approach was employed to extract pertinent information. For each selected paper or report, we ensured that the following details were systematically recorded:

- **Paper Metadata:** This includes the author(s), title of the paper, year of publication, and the journal in which it was published.
- **Data Source:** The specific database or platform where the paper was sourced from.
- **Regional Focus:** The specific region or community highlighted in the study, which helps in understanding the geographic applicability of the findings.
- **Barrier Description:** A concise summary of the main barrier to climate adaptation identified in the paper.

- **Nature of Barrier:** Each barrier was categorized based on its inherent characteristics. The categories we used for classification include Behavioral and Capability Barriers, Financial and Market Barriers, Knowledge, and Awareness Barriers, Political, Institutional, and Governance Barriers, as well as Technical and Data Challenges

3.3 Regional Data

Several identified barriers were linked to specific indicators in order to survey the landscape across EU regions. The data was collected between May and October 2023 using primarily Eurostat data at the NUTS2 level (including the EU regional Competitiveness Indicators and the European Quality of Government index developed by the European Commission. In addition, data from OECD Regional Statistics for Large Regions (TL2) were also leveraged after harmonization to bridge the modest differences in territorial nomenclature compared to the EU NUTS2 system. The data collection process aims not only to inform the discussion of this report but is also the first step for a P2R database for regions. In turn, this detailed panel dataset will be

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juxtaposed to the self-assessed information collected in WP1 and the granular data extrapolated from the participatory approaches and regional dialogues delivered in WP7.

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4 Scope of the Review

For the collection of information and data needed for the analysis of the running projects, the researchers used scientific published papers and reports to well-known journals and databases that provide accurate information (please see the list of references). We focused the literature review on papers and reports on European and other developed countries since 2000 appearing to have similar characteristics with the regions and communities that will be included in the running project. The selection of the published papers included was made not only based on geographical and temporal criteria but also on the methodologies included on each published paper. Our attempt is to scientifically support the methodologies that will be used in the running project with similar methodologies identified on previous research. Moreover, our attempt is to detect potential gaps in the literature and methodological approaches that can be fulfilled by the existing running project as a novelty.

Regarding the literature review, we eliminated publications prior to 2000 focusing on the latest climate change adaptation finance barriers reported in the relevant academic and brown literature to provide accurate and up-to-date information and knowledge. During the literature review process, identified that previous researchers used five (5) different geographical approaches regarding their samples as depicted in Figure 3. More specifically, most of the previous research, almost 34.38%, was carried out at the local level, focusing the sampling base on specific cities of interest. The second most common geographic approach was observed to be the regional sample approach, with a rate of 21.67%, either in the form of a cluster or by focusing on regions where they show common characteristics among themselves. National level surveys come forth in ranking with its percentage reaching almost 10.43%. In corresponding investigations, it was observed that the researchers studied individual cases of states regarding the obstacles, or made comparative analysis between states with similar characteristics, geographically, socio-economically, environmentally, etc. The percentage of research dealing with barriers on adaptation finance at the European level is the lowest compared to the rest of the studies, less than 3.15%, they are given a comparative advantage in the present research where a multitude of European countries participate at the regional level, giving us the opportunity to make comparisons both at the European level and at the regional level at the same time. A special case is that of specific groups with a percentage of almost 14.6%, where the participants do come from European countries, according to the criteria we have set, but the surveys have been conducted at a corporation level or at a level of organizations and services. Finally, some surveys provide limited to no information regarding their sample specifications.

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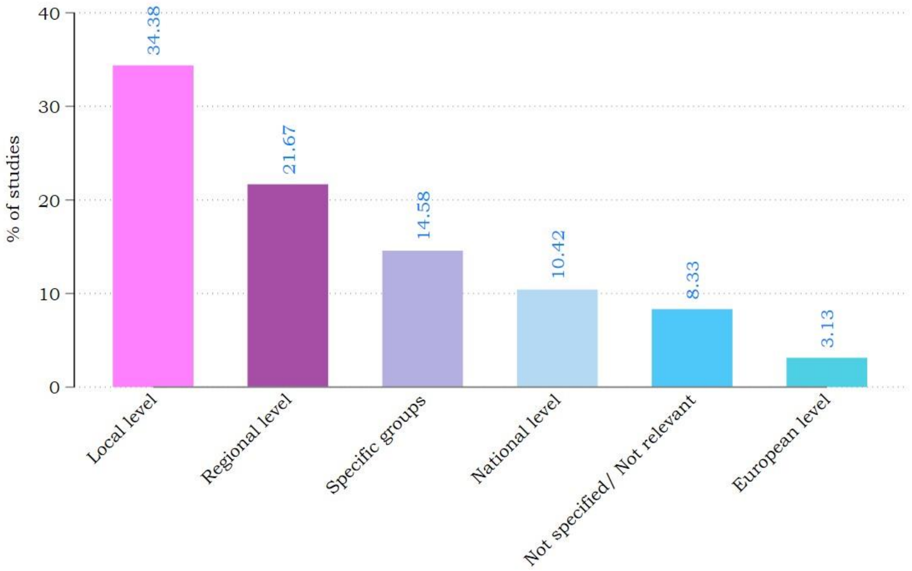
Figure 3: Level of Focus of Studies



Source: Authors' Calculations

On these 144 reports and published papers, different methods of data collection have been used (Figure 4) with document analysis, interviews and case study analysis being the most common (51.04%). The second most common method of analysis appears to be the literature review with its percentage reaching almost 26,05%. Published documentation which conducted in-person surveys as an approach of data collection are less than a quarter (1/4) of the total reports included in our analysis. Semi-structured interviews and workshops are some of the least common methods of data collection based on our literature review. The last positions in the rank are held by scenario development, regression analysis and online surveys. It is crucial to mention that multiple methods have been used in each publication.

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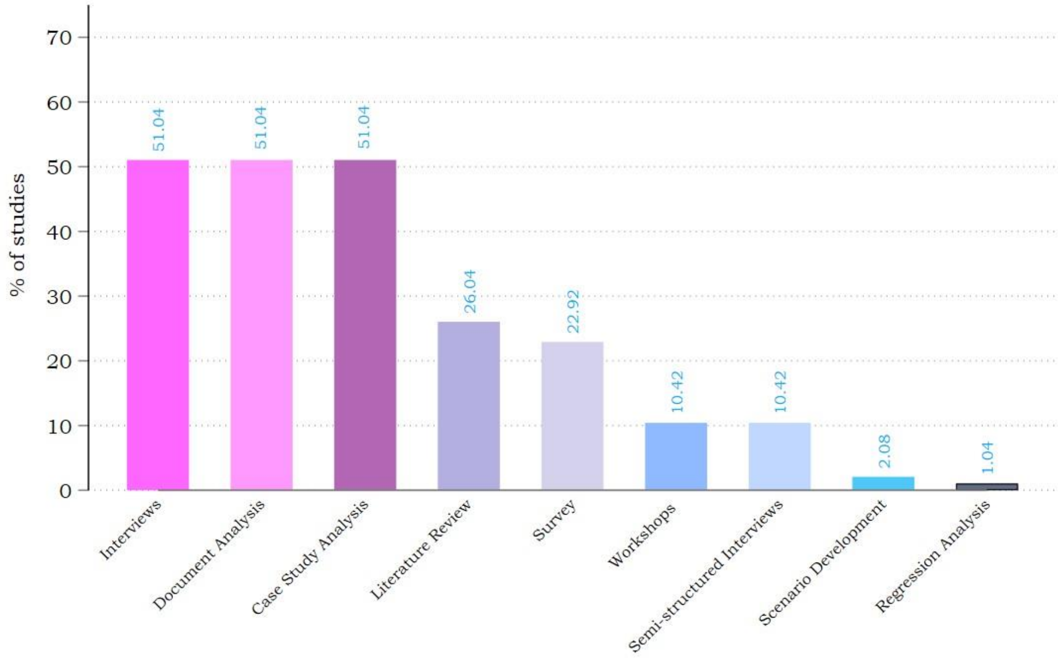
Figure 4: Methods used for Information Gathering



Source: Authors' Calculations

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5 Classification of Common Barriers to Climate Change Adaptation Finance

5.1 Established Categorization

According to the latest IPCC Synthesis Report (2023) there are sizeable barriers to climate change adaptation finance resulting in underinvestment among growing global needs[2]. The barriers include inadequate assessment of climate-related risks and concomitant prioritization of project outside adaptation, national economic constraints stemming from adverse macroeconomic conditions and competing needs for scarce funds, poor infrastructure and governance failures which do not allow for the mustering of financial resource but also stifle the efficiency of the adaptation projects that receive funding. The barriers to adaptation finance manifest with different frequency and different degrees of salience depending on the sector financing adaptation projects (public or private), the sector carrying out adaptation projects, the type of adaptation (reactive or anticipatory), and the ambition of adaptation projects (incremental or transformational).

In this section we aim to classify these barriers into five broad categories namely (i) economic and market barriers; (ii) socio-cultural and behavioral barriers; (iii), knowledge and awareness barriers; (iv) technological barriers and (v) political and institutional barriers. In each category we utilize the rich theoretical and empirical literature and examine each barrier with respect to (i) the hindering effect for attracting or generating finance for adaptation and (ii) the challenges it poses in leveraging financial resources for efficient adaptation plans. Regarding the latter category, this report underlines regional and national attributes which may not constitute barriers *per se*, but nonetheless shape regional capacity for adaptation. Hence, the lack or poor representation of such characteristics acts as a barrier for adaptation finance. Moreover, including structural capabilities of regions and stakeholders is pivotal in addressing climate adaptation and mitigation as a multifaceted process which warrants action from all sectors and levels of governance.

5.1.1 Economic and Market barriers

Lack of funds and high costs: The scarcity of funding remains a significant concern in climate finance literature. Ackerman (2009) indicates the severe lack of available funding and underscores the excessive costs associated with implementing mitigation and adaptation measures. Confirming these views, Chirisa et al. (2021) emphasize the restraining effects of the absence of finance, leading to an evident unwillingness or inability to integrate crucial adaptation practices and technologies. This scarcity extends to the private sector, as suggested by Timilsina (2021), who sheds light on the shortage of financial resources and the associated challenges in attracting private sector investments. Savvidou et al. (2021) also highlight the problem of inadequate finance, further compounded by a misused approach in targeting support and barriers that suppress the implementation of critical adaptation projects. Moreover, regarding investment needs and transformative actions Bowen et al. (2014) highlight the

[2] This report uses the term "financing" for directing funds for adaptation both through the use of internal funds (national or regional public revenues) as well as through market mechanisms for public or private entities.

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massive investments necessary to renovate energy systems, reimagine the built environment, and bring about infrastructural adaptations in the face of a changing climate.Cliquez ici pour entrer du texte.

Although the finance gap for both adaptation and mitigation is substantial (UNEP, 2023a; 2023b), global funds allocated to adaptation projects represent less than 5% of total climate funding for 2022 (CPI, 2023). Finance for climate adaptation poses unique challenges compared to finance for climate mitigation. Firstly, the effectiveness of adaptation actions is context-dependent and subject to various socio-economic, political, and environmental factors, making it difficult to assess the return on investment accurately (Berrang-Ford, 2011). Moreover, the distribution of costs and benefits associated with climate adaptation is often uneven and uncertain, exacerbating the challenge of financing adaptation efforts (Hallegatte, 2009). Hence, the long-term horizon inherent in adaptation projects and the increased uncertainty accentuate the scarcity of funds posing additional barriers to adaptation compared to mitigation.

Complexity and diversity of funding mechanisms: Altamirano (2021) examines the complex diversity of climate, water, and biodiversity funds, suggesting that their variety is creating systemic barriers, especially for local stakeholders. The increasing fragmentation of climate, water, and biodiversity funds and financing facilities is becoming a systemic barrier for local access to finance, with the author suggesting that novel governance structures for collective investments at the watershed level and innovative procurement strategies are required to address these barriers.

Inadequacy of current financial systems and approaches: A recurrent theme in climate finance dialogue is the inadequacy of usual financial systems. Baatz (2018) critically evaluates the scarcity of funding and touches upon the ethical dilemma concerning historical excessive emitters. This view of inadequacy is further expanded by Das (2022) who outlines substantial capacity gaps. Kartez & Merrill (2016) stress not just the insufficiency of funds but also a pervasive unawareness regarding adaptation's urgency. This dual dilemma of inadequate and inappropriate financing is separated by Lipper et al. (2022). Meanwhile, Miller (2008) improves this debate, underscoring the urgency of the situation and the inefficacies in resource allocation, respectively.

Coordination, fragmentation, and allocation challenges: Financial efforts, although present, often suffer from management issues. Clark et al. (2018) discusses the limited availability of funding and highlight how uncoordinated efforts often diminish the effectiveness of interventions.

Financial capacity and targeting challenges: Exploring the topic of financial capacity, Pillay et al. (2017) highlight the uncertainties of how climate change might impact us and point out the mismatch between the long-term benefits of investments and the short-term goals of investors. Adding to this complexity, Sietz et al. (2008) in their Mozambique study, detail a range of challenges, from individual limitations to broader network issues.

Competition for funds: Similarly, to allocation challenges, it is highly observed on the literature that researchers pay great attention to the competition for funds. More specifically, de Bruin and Dellink (2011) underline the restrictions regarding the level of adaptation finance by emphasizing both the limited access to funds and the competition for funds. One of the factors that worsen the competition for funds is the irreversibility of the investment decision due to the

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financial scarcity. As de Bruin and Dellink (2011) mention, it is crucial to evaluate all possible options and make the best decisions that will bring about the best possible funding and absorption of capital for the greatest possible results regarding society and climate change adaptation. **The unknown adaptation cost** is another factor that further complicates the process of adaptation finance as it is highlighted by Ford et al. (2010b) and de Bruin and Dellink (2011) since it as it increases the uncertainty of the policy makers who bear the responsibility of adopting and implementing projects for the confrontation of climate change.

Lack of human resources: Researchers examining similar issues in the existing literature (Moser et al., 2008; Biesbroek et al., 2009; Krysanova et al., 2010; Ford et al., 2010a; Martins and Ferreira, 2011; Aguiar et al., 2018) report that one of the most important reasons that pose barriers to climate change adaptation finance is the lack of human resources. More specifically, Moser et al. (2008) highlight that climate change adaptation strategies may fail due to lack of human resources. It is observed that, not only is the available capacity of human capital limited, but also, the phenomenon of brain drain has worsened the existing situation.

Lack of skilled personnel: Following the analysis on the lack of human resources, the researchers consider the availability of specialized personnel who can focus and delve sufficiently into the ways of managing climate change, the analysis of available information and the proper utilization of financial resources in order to address the causes and also of the results of this phenomenon. Bryan et al. (2009), Ford et al. (2010b) and Moser and Ekstrom (2012) highlight the insufficient number of skilled personnel who can gather and scientifically analyze collective information in an effort to implement the most appropriate solution to the climate change problem at hand, while Biesbroek et al. (2009) underlining that one of the main factors leading to this situation is the lack of knowledge about the existing situation of the area that they should manage as well as the importance and effects of climate change. Moreover, the transformative adaptation is contingent on regional and national innovation, which in turn, is intrinsically linked to skilled personnel. Figure 5 shows the fragmentation with respect to knowledge workers in the EU. Regions in Spain, Greece, and Eastern Europe struggle to find people with skills necessary for transformative adaptation. Figure 6 also highlights the divergence in business structure, as regions in Eastern and Southern Europe record very low rates of employment in knowledge-intensive activities. The data underlines both the deficiencies in human capital across EU regions and the fragmented functioning of labor markets. Regions deficient in advanced skills and knowledge-intensive employment face significant barriers in designing, implementing, and monitoring transformative adaptation projects.

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Figure 5: Knowledge Workers

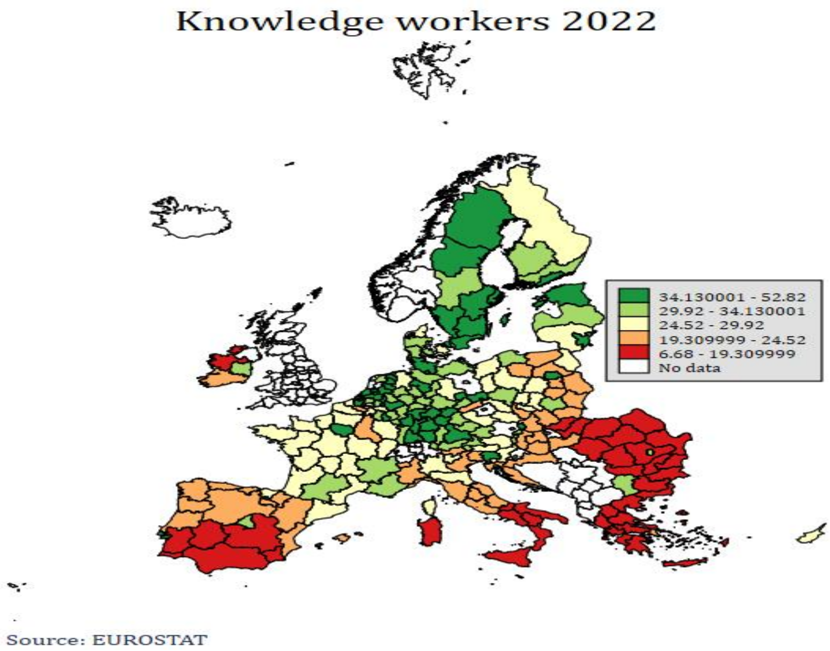

Figure 6: Employment in Knowledge Intensive Activities

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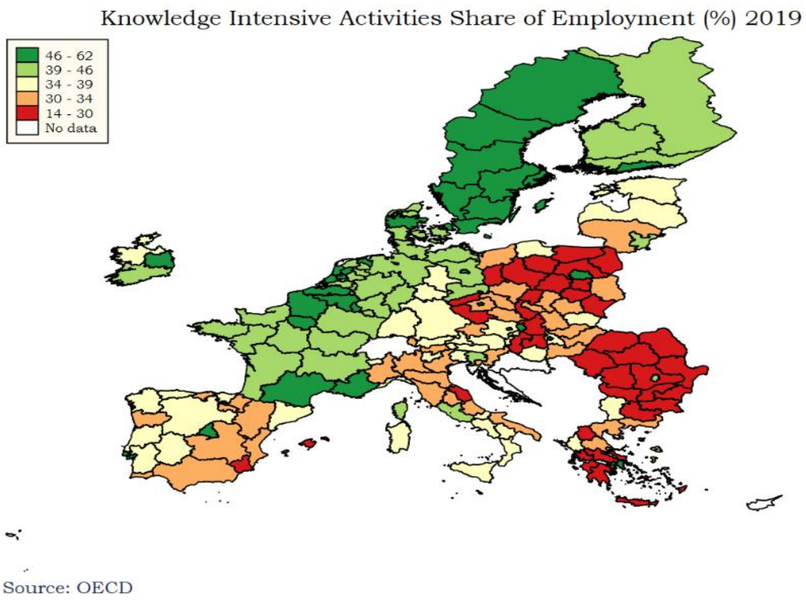

Lack of public demand: Due to the lack of knowledge, not only of the personnel but also of the citizens, Mosel and Ekstrom (2012) emphasize the fact that society does not seek immediate response and management of climate change. This lack of public demand leads policymakers to devote more time and funds to other social issues, limiting the funds that can be allocated to climate change adaptation finance. In the sense that transformative adaptation is contingent on innovation production and diffusion, the demand channel is of material importance. Functional innovation systems at the national and regional level depend on strong demand tailwinds for tilting the cost-benefit analysis towards the promotion of innovation (Soete et al., 2010).

Conflicts with other more pressing developing issues: Society, along with the scientific community, has to tackle more than one developing issue simultaneously, making prioritization a difficult process since the criteria of the process are not clear and moral rules that can identify the significance of each developing issue do not exist. This barrier has been mentioned in literature by multiple researchers (Storbjörk, 2007; Moser et al., 2008; Brown et al., 2010).

Time frame and conflicted time scales: The limited time we have, combined with the immediate solution needed for climate change issues as well as other pressing developing issues in several regions, increases the competitive time scales. According to Allman et al. (2004), the time frame we have available to address all these important issues and their implications is limited. Simultaneously, however, time should be allocated to other equally important issues, leading policy makers to a quagmire regarding the rational management of the available time between conflicted developing issues (Few et al., 2007; Biesbroek et al., 2009; Burch, 2010; Ford et al., 2010b, Biesbroek et al., 2011; de Bruin and Dellink, 2011; Sutton and Tobin, 2011; McNamara et al., 2011; Aguiar et al., 2018).

Climate concerns in development strategies: Mitchell, Tanner, and Wilkinson (2006) discussed the insufficient research on integrating climate change concerns within Poverty Reduction Strategy Papers (PRSPs). Given PRSPs' central role in shaping a nation's developmental blueprint, it's essential to incorporate a climate-focused lens. Przyluski & Hallegatte (2010) delved into the complexities of financial support for climate adaptation. They highlighted issues

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around vague concepts and the difficulty in defining and quantifying terms like "additionality" and "incremental cost." The research also emphasized the importance of clear strategies and raised concerns about ownership rights.

Macroeconomic Factors: Adger (2000) pays attention to the macroeconomic factors that may influence a region's ability to attract funds regarding climate change. Based on Adger (2000), one of the most important variables may be poverty levels, since the authorities of each nation or region will set priorities and will place the living conditions of its citizens in a high level of significance, spending money on attempts to exceed the poverty line and provide better livelihood to its citizens. Similarly, Reckien et al. (2015) mention unemployment rate as a significant macroeconomic factor, especially to the regions that appear to be less developed, compared to the rest of the country. Figure 7 highlights the vast differences in disposable income. The 2009-10 crisis in the Eurozone has had a scarring effect in many of the bloc'sregions, thus prioritizing policies towards economic rebound, sometimes at the expense of climate action. The divergent macroeconomic conditions are evident in Figure 8 which shows the latest data on unemployment rates. The high unemployment levels reported especially in Southern European regions (in Spain, Italy, and Greece) put pressure on policymakers to channel scarce funding to short-term economic measures that support employment creation, thus downgrading the urgency of climate adaptation projects.

Figure 7: Disposable Income per capita

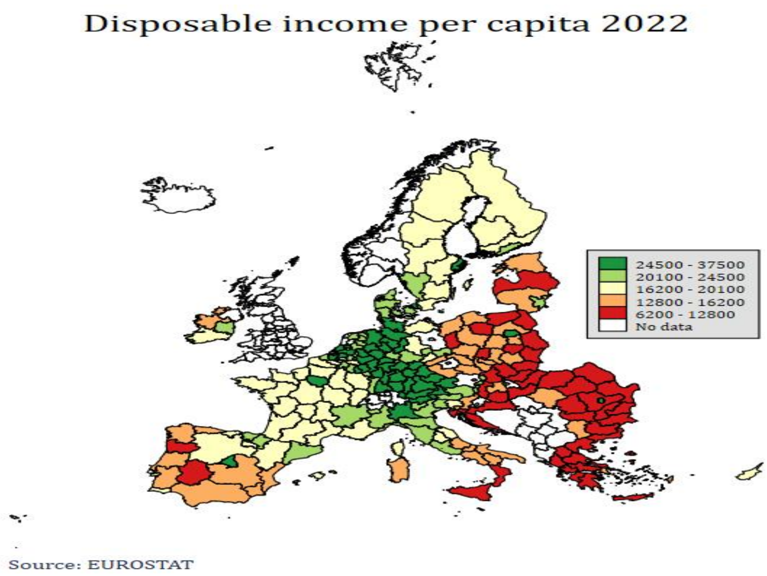

Figure 8: Unemployment Rate

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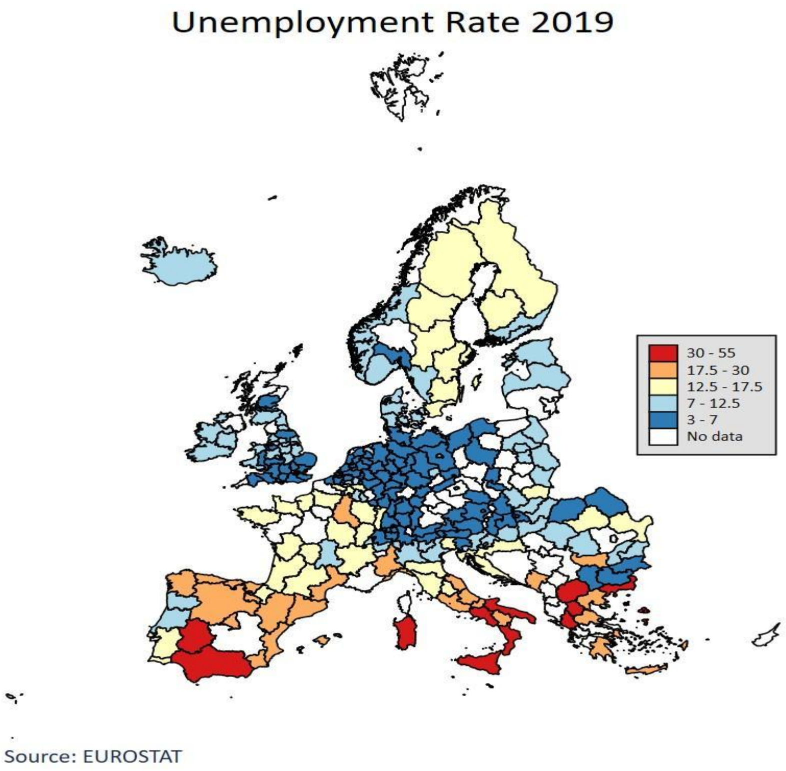

5.1.2 Socio-cultural and Behavioral barriers

Lack of Commitment from Developed Countries: Bouwer & Aerts (2006) highlight a major issue: developed countries are not showing enough commitment to adapting to climate change. The researchers stress the need to make climate change adaptation a central focus to tackle these problems and propose a two-track approach for financing adaptation: one track focuses on securing climate change adaptation funding under the UNFCCC, while the other track aims to improve the mainstreaming of climate risk management in development efforts. Adding to this perspective, Syrovátka (2009) points out that current international funding for adaptation in developing countries falls short of the estimated costs required for adequate adaptation, underscoring the urgent need for augmented financial resources. As the impacts of climate change escalate, existing financial mechanisms appear increasingly inadequate for meeting the growing needs for adaptation, suggesting a necessity for innovative funding instruments such as the auctioning of emission allowances or imposing taxes on international transport. Moreover, the challenges of allocating resources efficiently and equitably, along with the integration of adaptation into development assistance, remain significant. The integration of development and adaptation policies is deemed beneficial; however, it should not compromise the existing levels of development assistance. This approach necessitates an increase in financial resources to ensure both development goals and adaptation needs are met effectively.

Capacity Challenges and Commitment Issues: Doshi & Garschagen 2020 study focuses on the real-world problems faced by vulnerable countries. They point out two primary obstacles: the inability to effectively manage and carry out projects, and a noticeable lack of dedication to addressing climate change among key players. Management practices are considered a notable factor for private enterprises, akin to a unique technological asset and are associated with enhanced productivity and innovation performance (Acemoglu et al., 2007; Bloom et al, 2016).

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Especially for the case of private financing for adaptation (which faces a significant documented gap) managerial skills and business ethics are of pivotal importance for designing, implementing and monitoring bankable adaptation projects.

Mobilization of Funds: Fankhauser et al. (2016) explored the ability of investors to gather the necessary funds for climate change adaptation. Their study highlights the noticeable shortfall in climate finance and discusses the reasons and challenges behind this gap. . Enhancing access to finance is vital for tackling climate change, necessitating an assessment of the capability of investors to gather the required funds. Fankhauser et al. (2016) indicate that climate investment in non-OECD countries ranges between USD 165 billion and 180 billion annually, with a substantial 90% allocated towards mitigation efforts. Notably, the bulk of climate finance in these countries originates from private sources, with both domestic investments and South-South flows contributing significantly. Conversely, climate aid from developed nations constitutes less than 12% of the total climate investment in non-OECD countries. The scarcity of climate finance from public sources highlights the importance of just fund allocation, because traditional criteria for allocation have emphasized efficiency and equity; however, it's critical to also consider the degree to which potential recipients face limitations in generating capital for climate investments. Interestingly, the presence of financing gaps does not always align with high overall investment needs. While some sectors with substantial investment requirements enjoy reasonable access to finance, others encounter significant barriers, indicating a complex landscape of financial accessibility for climate adaptation and mitigation projects.

Lack of Willingness to Act and Pay: Biesbroek et al. (2011) mention a crucial behavioural factor that influences climate change adaptation underlining the limited motives and lack of willingness to act against climate change impacts. Jenkins (2012) on their studies highlight citizens' lack of willingness to change behaviour regarding climate change phenomenon and as a result their willingness to pay in an attempt to improve the existing situation. According to the latest Eurobarometer (2023), more than 60% of EU citizens consider climate change a serious problem, however the share varies from 28% in Romania to 82% in Luxembourg. The pronounced divergence in attitudes towards climate change and climate action significantly skew the amount and the efficiency of funds dedicated to climate adaptation. Having said that, this barrier is associated with the quality of regional governance and other institutional barriers (see section 5.1.5).

It is crucial to note that there are ethical implications that shape the fair distribution of global adaptation costs among countries, as well. Dellink et al. (2009), investigate the ethical dimensions of adaptation financing through lenses such as deontology, solidarity, and consequentialism and we see a broader ethical framework emerging. This framework underscores the necessity of grounding financial contributions in a deep understanding of ethical principles that consider historical responsibility for climate change, the international distribution of wealth, and the capacity of countries to contribute.

5.1.3 Knowledge and Awareness barriers

Lack of awareness: Through the study of literature, the three most common categories of awareness on the topic of climate change adaptation finance. Allman et al. (2004) report that the first and most significant lack of awareness is the one referring to the need for adaptation. **The lack of awareness of the need for adaptation** was subsequently reported by other researchers

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following the Allman et al (2004) statement (Koch et al., 2007; Amunden et al., 2010; Storbjörk, 2010; Burch, 2010; Biesbroek et al., 2010; Biesbroek et al., 2011). McEvoy et al. (2010), on the other hand, highlight the significance of the **lack of political awareness**, emphasizing that the members of the society who are responsible for acting regarding the climate change adaptation are lacking knowledge and as a consequence of awareness on such a crucial issue. Last but not least, the aspect of the **lack of awareness among general population** is a statement raised by Brown et al. (2010) who shed light on the fact that the general lack of awareness and information of the population derives from the already mentioned scarcities and prevents citizens from knowing and understanding the need for climate change adaptation.

Lack of specialized knowledge: A priori information and knowledge is one of the most powerful tools for predicting and solving serious social and environmental issues. Following McEvoy et al. (2010) statement regarding the political unawareness, Huang et al. (2011) report that one of the most common barriers observed appear to be the **lack of specialized knowledge within the government**, underlining the need for collaboration between the academic community and society. Moser and Ekstrom (2010) on the other hand, prioritize the barriers and shed light to the fact that there is **lack of local expertise** which will be responsible to provide the needed information to the government in order to create mitigation and adaptation strategies. The last two barriers regarding the lack of knowledge are highly correlated since the **lack of data and information** (Moser and Ekstrom, 2010; Sietz et al., 2011; Aguiar et al., 2018) create obstacles to research and gain of scientific knowledge. For that reason, Aguiar et al. (2018) support the idea that the most significant barrier regarding knowledge is the **lack of scientific knowledge** since both the general population and the governments will be educated and informed from the scientific community.

Lack of attention, strategic planning, and responsibility: Considering all the previous barriers that have been mentioned in this section, we must also mention the barriers caused, as the literature states, by the lack of knowledge and awareness. Political unawareness and lack of specialized knowledge within the government lead to **lack of national attention** (Ford et al., 2010a; Lebel et al., 2011; Amunden et al., 2010; Martins and Ferreira, 2011) regarding both climate change adaptation and adaptation finance. The nations pay more attention to other pressing issues, ignoring the significance of climate change adaptation. As a consequence of this barrier, the governments and the in-charge policy makers avoid creating preparedness plans leading **to lack of strategic planning and responses** (Biesbroek et al., 2009; Lemieux et al., 2011; Measham et al., 2011). Another common phenomenon observed. Another phenomenon that is strongly observed in modern societies is the avoidance of responsibilities and obligations. Similarly, in the case of climate change and strategic planning for adaptation finance, it is commonly stated that decision makers and most commonly governments tend to **externalize the responsibilities and put the blame on others** in an attempt to avoid taking action (Lorenzoni et al., 2007).

5.1.4 Technological barriers

Lack of technical resources and ICT support: Allman et al. (2004) and Brown et al. (2010) mention the importance and the need for a technical system that will be able to provide accurate data and information as well as support the registration of data and events that will then be

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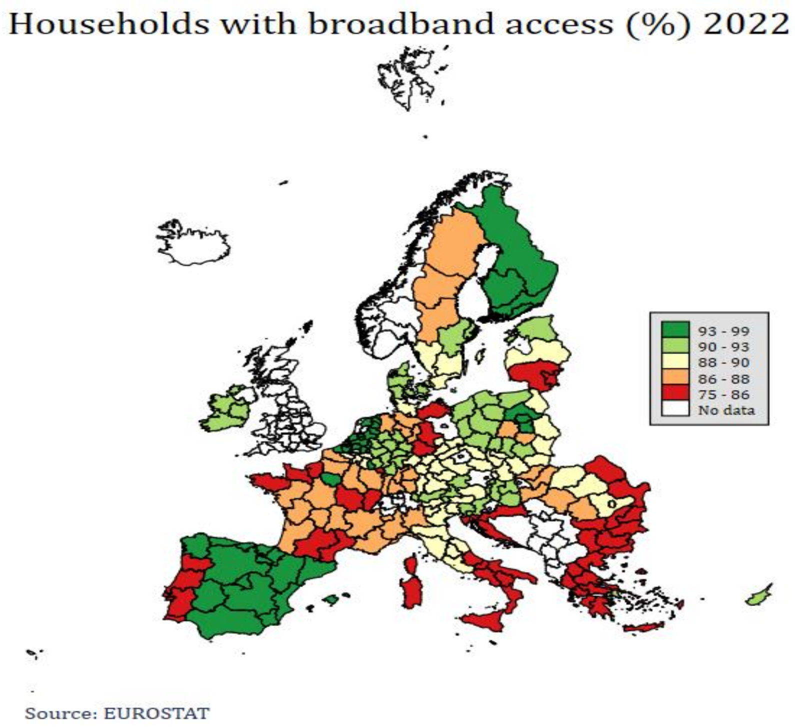
analyzed by scientific and research teams in order to provide knowledge and information. The correct recording and processing of the data will offer accurate and immediate results useful for effective strategic planning. Figure 9 shows the share of households with broadband access as an indicator oof technological infrastructure. Having said that, a low degree of broadband penetration consists of a barrier for information and awareness for the general public.

Figure 9: Households with Broadband Access



Inferior performance by regional innovation: Burch (2010) highlights the poor performance by regional innovation especially to developed countries and regions, emphasizing the limited education and research establishments. Innovation capacity at the regional level is not an explicit barrier to adaptation finance, however it significantly catalyzes financial resources for transformational adaptation. Regional and national innovation systems can be material for adaptation strategies, especially for projects involving the private sector either directly or as a sub-contractor for a public project. Innovation and technology upgrading is of material importance for regions to escape the development trap, that is subpar economic growth leading to growing discontent and euroscepticism (Rodriguez-Pose et al., 2023). Figure 10 shows the concentration and geographical clustering of R&D activities in a few regions. R&D spending is a fundamental input for innovation, albeit collaborating with many forces in the economy including regional social filters, skills and cross-regional mobility and trade (Crescenzi & Rodriguez-Pose, 2011).

Figure 10: R&D Expenditures

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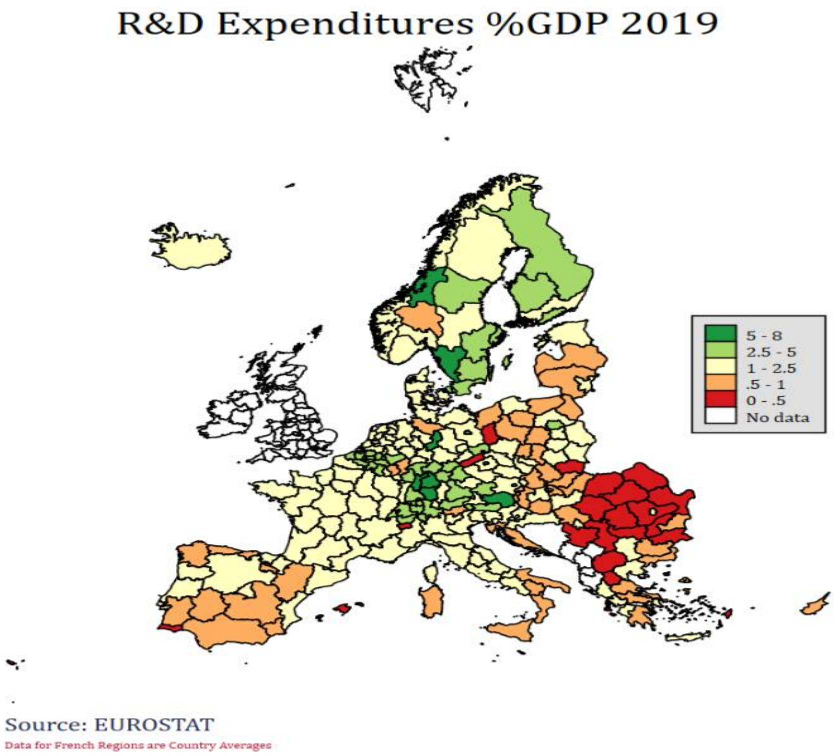

Nonetheless, one can easily note the correspondence with innovation output in Figure 11 which shows patents across EU regions[3]. The substantial inter-regional innovation divergence in the EU exacerbates the region's deficit as a whole vis-à-vis its peers (USA, China, Japan, and South Korea) as it complicates any EU-wide innovation policy design and clashes with EU Cohesion Policy (Veughelers, 2016). This innovation divergence is inherently linked to development divergence, as regions lagging in innovation and focusing on low-skill and low-technology activities are less likely to expand to economically complex activities and enhance productivity growth (Pinheiro et al., 2022), Hence, these regions are lagging in their ability to us innovative solutions for current adaptation problems and, in addition, are expected to face low growth in the medium- and long-term further constraining their adaptation capabilities.

[3] Acknowledging the fact that patent counts (as any other measure) are not an impeccable measure of innovative activity, we include them as an innovation metric as they contain useful information, available for cross-country comparisons and approximate innovative output in a manner that allows for empirical exercises (Acs *et al*, 2002; Rodriguez-Pose & di Cataldo, 2015; Mohnen, 2019).

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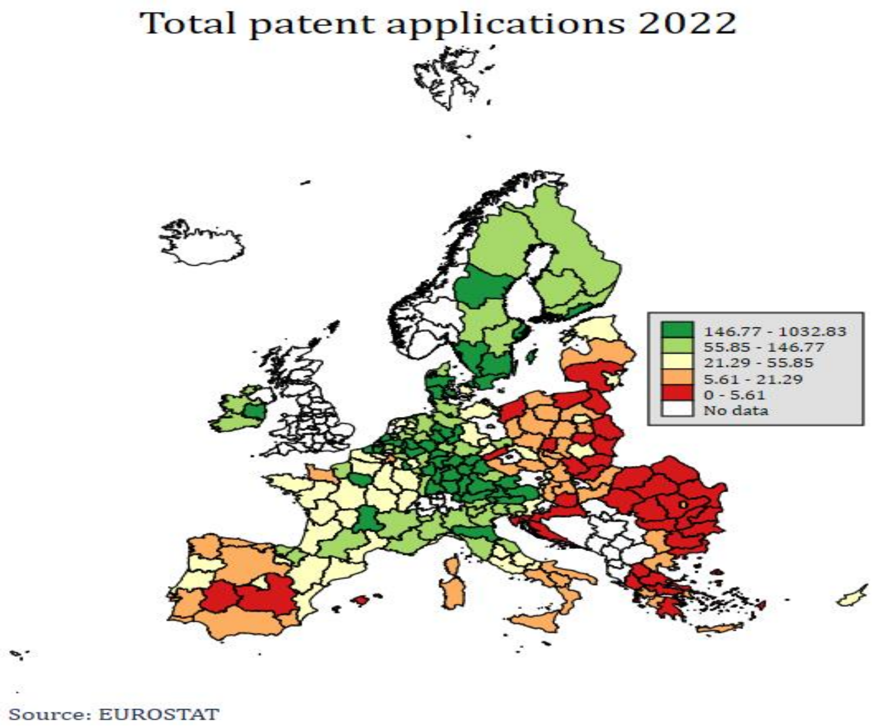
Figure 11: Total Patent Applications



Data gaps: Biagini et al. (2014) identified a significant gap in empirical data regarding climate adaptation actions funded by the Global Environment Facility. They pointed out that limited data, combined with inadequate funding, can disrupt informed decisions. This combination of technical and financial issues might obstruct effective climate adaptation efforts. Closset et al. (2018) highlighted a key issue: the lack of reliable indicators to determine climate change vulnerability. Without these indicators, efficiently allocating resources becomes challenging, resulting in resource wastage.

5.1.5 Political, Institutional and Governance barriers

Lack of cooperation and **multi-level** communication: Evans et al. (2011) and Fayazi et al. (2020) focus their studies on the political and governance barriers regarding climate change adaptation finance. Initially, Evans et al. (2011) state that **a lack of cooperation within and across sectors** has been observed leading to inefficient activities that could help in the proper absorption of financial resources. On the other hand, Fayazi et al. (2020) underline the limited communication. The lack of multilevel communication, as mentioned by Fayazi et al. (2020), creates. gaps and incomplete knowledge that hinders proper and effective management.

Governance failures: McNamara et al. (2011) report the aspects of governance failures to climate change adaptation and adaptation finance. As mentioned by Moser and Ekstrom (2012), the failures of governance may be caused due to **lack of leadership** (both on elected members

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and organization staff), with decision makers attempting to avoid and abdicate any responsibilities. Evidently, lack of leadership and the externalization of responsibilities lead to the **loss of trustworthiness in the relationships between communities, governments, and scientists** (Gross et al., 2011). The lack of trusted relationships between community members and citizens may also be caused due to the **lack of vision of each government, lack of political will and commitment** (Moser and Ekstrom, 2012), making the government member appear irresponsible and with no strategic plan for adaptation and development. Gross et al. (2011) also refer to the lack of vision through the fact that **lack of management structures with long-term perspectives** has been observed to most regions, a statement that can also be connected to the McClure and Baker (2018) statements regarding both the **uncertainty of state planning policies** and the **local government priorities** that may not include any climate change adaptation plan in the short-term. Figure 12 shows the differences in quality of governance according to the EQI index and Figure 13 focuses on the corruption pillar. As is evident from both figures, governance patterns are, to a large extent, national with the proverbial exception of Italy where there is a notable north-south divide. Over the past decade, some regions in Eastern Europe have outperformed regions in southern EU countries such as Italy and Greece, whereas in some cases in Poland and Hungary, the response to the COVID-19 pandemic resulted in some infringement on democratic rights (Charron et al., 2021).

Inadequate coordination and cooperation among regional authorities can lead to fragmented responses, resulting in inefficient allocation of resources and missed opportunities for effective adaptation measures. Without cohesive regional governance structures, initiatives such as developing climate-resilient infrastructure, implementing land-use planning strategies, and enhancing community resilience may be hindered by conflicting priorities and disjointed decision-making processes Sound institutions lie in the epicenter of regional and national innovation systems, thus shaping innovation performance across regions (Rodriguez-Pose and di Cataldo, 2015). Having established the importance of regional innovation for adaptation in 5.1.4, one can note the additional channel through which poor institutional performance can manifest as an implicit barrier for climate adaptation.

Figure 12: Quality of Governance (EQI)

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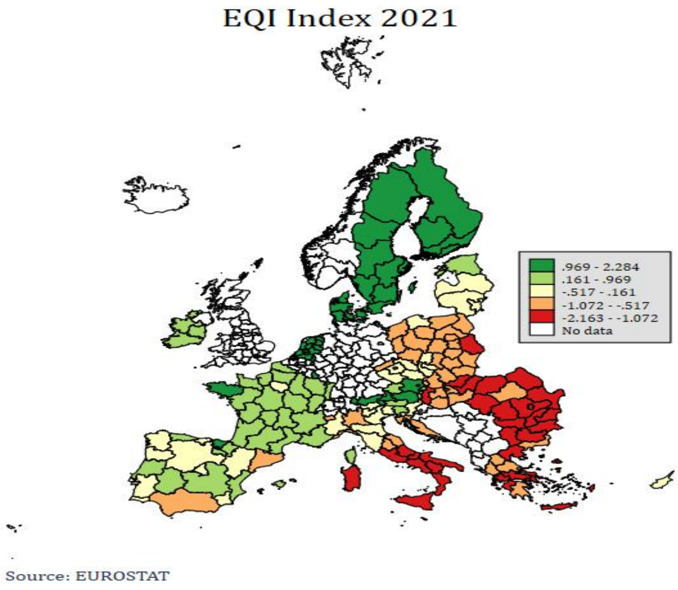
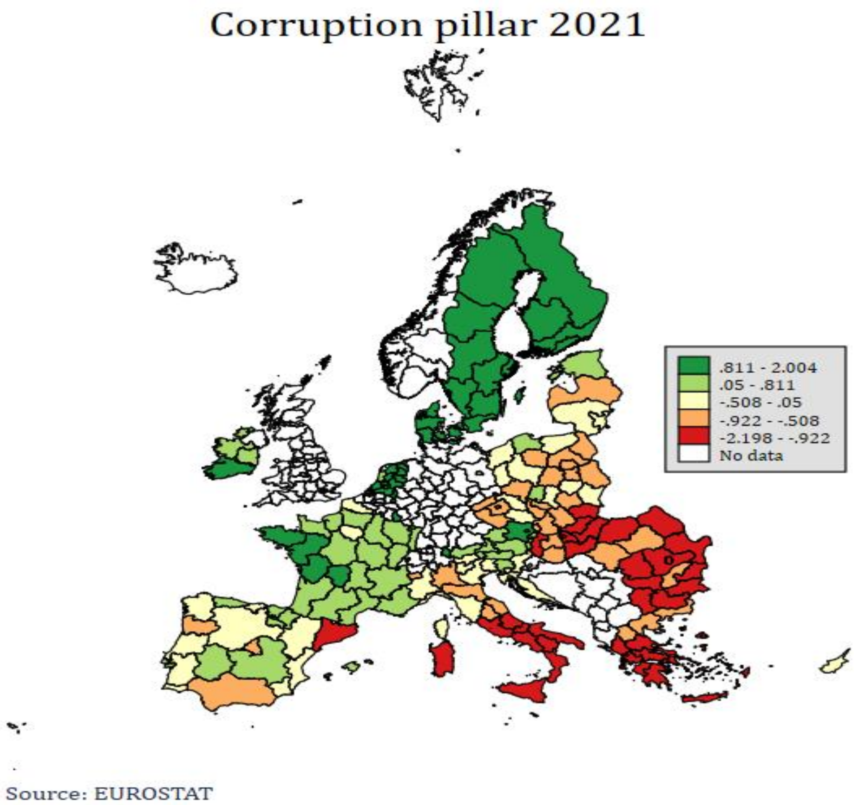


Figure 13: Corruption Index (EQI)



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Box 1: Manifestation of Barriers to Adaptation Finance

Barriers and capabilities for Adaptation Finance manifest (in most cases) in two forms through the adaptation finance process. Firstly, they hinder access to financial resources essential for implementing adaptation measures. Despite the availability of various funding mechanisms at both EU and national levels, knowledge gaps, governance failures, administrative complexities, eligibility criteria, and bureaucratic hurdles often restrict the accessibility of funds for regional actors, particularly smaller municipalities, and local communities. Secondly, even when financial resources are secured, barriers persist that impede the effective leveraging of these funds for successful adaptation projects. Inadequate technical capacity, limited expertise in project design and implementation, and insufficient coordination among stakeholders can undermine the efficiency and impact of adaptation initiatives. The dual manifestation of barriers, direct or in the form of subpar regional capacity is evident across the categories outlined in section 5.1. Examples of the "double trouble" induces by specific barriers include:

1. **Economic and Market Barriers**

o **Access to Finance**: Low levels of business sophistication and the concentration of small and micro enterprises hinder the access to financial capital for the private sector.
o **Leveraging Financial Resources**: Financial resources allocated to targets other than adaptation, due to adverse economic conditions, for example high unemployment and the recent cost-of-living crisis, which warrant support from public resources

2. **Socio-cultural and Behavioral barriers**

o **Access to Finance**: The public's lack of recognition for the urgency of climate adaptation measures downgrades the salience of seeking adaptation finance for both the private and the public sector (the latter through the choice of representatives and the prioritization of public funding)
o **Leveraging Financial Resources**: Inadequate community engagement and behavioral lock-ins hamper the long-term viability of adaptation projects, for example through maladaptation

3. **Knowledge and Awareness barriers**

o **Access to Finance**: Poor identification of tailored funding opportunities and procedures and disconnect with ongoing EU projects, networks, and platforms
o **Leveraging Financial Resources**: Lack of actors to engage in adaptation actions and managerial/informational shortcomings lead to the inadequate design of bankable adaptation projects
Box 1: Manifestation of Barriers to Adaptation Finance (cont.)

4. **Technological Barriers**

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o Access to Finance: Minimal presence of innovative firms and innovation systems to design transformational adaptation solutions, which have higher chance of receiving EU funding

o **Leveraging Financial Resources**: No functioning innovation systems and low inter-sectoral cooperation thwarts the efficiency and bankability of adaptation projects

5. Political, Institutional and Governance Barriers

o **Access to Finance**: Myopic regional (and national) governments focusing on short-term issues and political-electoral cycles reduce the financial resources dedicated to climate adaptation

o **Leveraging Financial Resources**: Governance failures result in the misdirection of scarce financial resources away from impactful adaptation projects

5.2 Performing Sector and Transformational Adaptation

5.2.1 Barriers for Transformational Adaptation

Based on the literature review that has already been discussed, we categorize the identified barriers affecting Climate Change Adaptation Finance based on whether they affect incremental projects, transformational projects or intermediate projects that appear to move forward to transformational adaptation. Fostering transformational adaptation is at the core of the Pathways to Resilience project, as it aims to equip regions with the skills and resources to radically transform their capabilities beyond low-scale, reactive adaptation.

IPCC (2023) defines climate adaptation as “the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects”. Having said that, the report distinguishes transformational adaptation as “[the one] that changes the fundamental attributes of a social-ecological system in anticipation of climate change and its impacts”. Pathways to Resilience specifically aims at developing and co-shaping transformational adaptation strategies for EU regions. EU regions must embrace transformative adaptation to effectively manage the multifaceted risks posed by climate change, including extreme weather events, sea-level rise, and ecological disruptions. The first step in the process, therefore, is the further refinement of the adaptation finance barriers regarding their salience in transformational rather than incremental adaptation efforts.

Through the process of refinement of the adaptation finance barriers we attempted to place the identified barriers in a scale from -1 (incremental projects) to +1 (transformational projects) following the literature review indications.[4] In some cases, we observed that some projects were neither fully incremental nor fully transformational and as a consequence, an intermediate state was created which encounters all projects that may appear in both cases. Figure 14 illustrates

[4] According to our knowledge, and based on extended study of the literature review, there is no published research findings or discussion paper providing scientifically justified weights on barriers based on their form (incremental, intermediate, and transformational). For that reason, we attempt to create our scale classification. The authors attempted to follow a weighting procedure; however, scientifically based justification of these weights is not possible as there are no documented results in the literature.

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the results of this process, where pink lines refer to the transformation projects, purple lines refer to the intermediate projects and, finally, light blue lines refer to the incremental projects.

Figure 14: Barriers for Transformational Adaptation

Source: Authors' Calculations

5.2.2 Source of Finance and performance

Another categorization that has been made is based on the source of finance for a proposed project. Three categories of sources of finance have been identified (public sources, private sources, and blend form of sources). According to our extensive study, we try to depict the complexity of the analyzed field by combining the forms of projects with the source of finance. For that reason, we created a figure (Figure 15) in which we allocate the identified barriers on those three categories (public, private and blend form of source) while at the same time we indicate whether those barriers appear at incremental, intermediate, or transformational projects. In other words, Figure 15 depicts barriers of public source of finance in the pink part of the circle, while barriers of private source of finance appear on the light blue circle. The union of the two circles (purple part) includes all barriers that belong to the blend form of source of finance.

Moreover, its barrier is highlighted with a different box color based on the incremental-transformational categorization presented above. More specifically, green line boxes refer to the incremental projects, yellow line boxes refer to the intermediate projects, while red line

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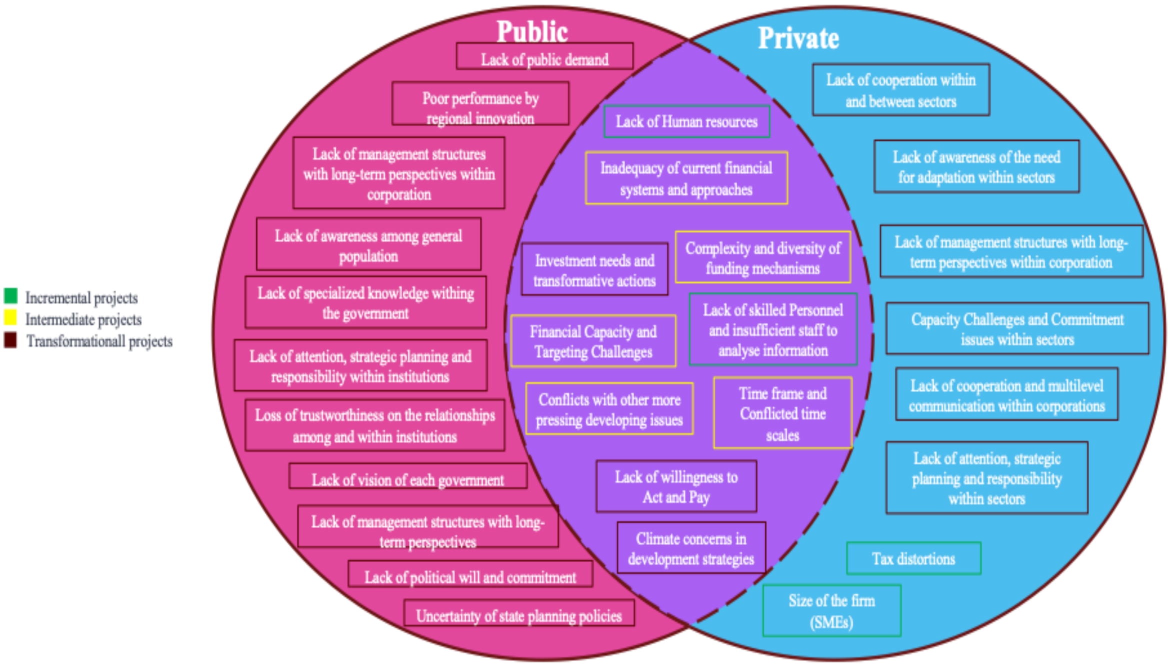
boxes refer to the transformational projects. As a result, Figure 15 combines the finding of both analyses presented above.

Public Sources: following the case study analyses held by multiple authors (Gawel et al., 2018; Klein et al., 2014; Hamin et al., 2014; Bierbaum et al., 2013; Bedsworth and Hanak, 2012; Baker et al., 2012; Measham et al., 2011; Falaleeva et al., 2011; Lebel et al., 2011; Norman, 2009; Schanze et al., 2008; Bouwer and Aerts, 2006)) we categorize the indicated barriers which refer to funds that are allocated to countries, regions or corporations and derive from international and/or European organizations. Regarding the corporations, public funds may come from international and/or European organizations or from the government. A great majority of barriers is allocated to public sources of finance and is focused on issues deriving from lack of information, awareness, or willingness to act.

Private Sources: similar case studies and published academic papers have identified the private sources regarding climate adaptation and resilience (Pauw et al., 2016; Kato et al., 2014; Pauw and Pegels, 2013; Buchner et al., 2011; van Drunen et al., 2009) refer to funds that are allocated to countries, regions or corporations and derived from the private sector. These funds may be tax revenues due to corporations' economic activities, a form of compensation of pollutants to the government and local authorities, or a form of donation to the government and local authorities. In comparison to public sources of funding, we can observe that in private sources, managerial and corporation challenges are those that set barriers to climate adaptation finance. In addition, tax rates receive great attention when discussing funding availability.

Blended: this category refers to funds that are allocated to countries, regions or corporations and derived from both the public and the private sector. These two sectors can co-fund such actions related to climate change adaptation with the private sector referring to these financing processes as part of their CSR policy.

Figure 15: Source of Finance



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Source: Authors' Calculations

5.3 How do the identified barriers affect Bankability?

According to the researchers and the studied literature, one of the main elements that can influence the path of a region or even a country towards the achievement of Mission Adaptation is to propose bankable adaptation projects. Such projects are characterized by their financial viability and attractiveness to investors, making them instrumental in securing the necessary funding for implementing adaptation measures. By demonstrating clear economic returns and risk management strategies, bankable adaptation projects not only attract private investment but also facilitate access to public funding sources, such as grants and concessional finance. Moreover, bankable adaptation projects contribute to the sustainable development of EU regions by generating multiple co-benefits beyond climate resilience. These projects can create employment opportunities, stimulate economic growth, and enhance social well-being, thereby fostering inclusive and equitable development. Additionally, bankable adaptation projects often integrate innovative technologies and nature-based solutions, leading to environmental co-benefits such as biodiversity conservation, ecosystem restoration, and reduced greenhouse gas emissions. Of course, the issue of bankability appears mainly in more innovative and transformational adaptation projects where governments or financing organizations are concerned about the development and successful completion of the proposed project. According to Ellis and Pillay (2017) the definition of bankability regarding climate change projects differs from the traditional definitions when referring to financial returns. When taking Climate Change Adaptation and Mitigation into consideration one should not judge projects based on their forecasted returns and profits, which is a common process when assessing investments.

First and foremost, not all outcomes of Climate Change Adaptation and Mitigation projects are measurable, thus, their exact value cannot be calculated and forecasted, while at the same time, we should consider the fact that the benefits of those projects aim to affect and upgrade the living conditions of the society and at the same time allow this generation to bequeath to the next generations a more sustainable environment. The great and most important question that arises in this matter is which of the identified barriers affect bankability and how. If we commence our analysis based on what we have already mentioned, we could say that the concept of bankability is primarily related to the more complex and transformational barriers. One of the challenges associated with developing bankable projects relates to skills and capacity to write strong project proposals, including access to data and information to support this process (Ellis and Pillay, 2017). Taking this into account, we can emphasize that project uncertainty due to various barriers is one of the key factors that can affect the bankability of innovative proposals.

In this section, we will shed light on some of these factors. Following the graph of Barriers to Transformational Adaptation (Figure 14) we will focus our discussion on the upper part of the ranking. Starting with the political aspect, multiple barriers can be identified such as lack of political will and commitment, lack of political awareness, lack of commitment from developed countries and or regions, however, some barriers are mainly attached to the government and not to the local authorities such as lack of vision of each government, lack of leadership and loss of trustworthiness on the relationships between authorities and citizens.

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Focusing on the local authority responsibilities regarding Mission Adaptation, we should underline the lack of local expertise who will identify the needs of each region and provide innovative approaches and solutions. Having said that, we can emphasize the lack of awareness of the need for adaptation, lack of specialized knowledge withing the government and local authorities as well as the poor performance by regional innovation. Tall et al. (2021) who conducted the World Bank Report regarding the Enabling Private Investment underlined the need for a National Adaptation Investment Plan development in an attempt to facilitate the translation of long-term adaptation strategies and goals into a national adaptation investment plan with a portfolio of both required policy measures & investments, with assessment of bankability. Before we discuss the general population aspect, we need to mention another element that may affect bankability and this is the long-term planning and communication that may increase the existing the uncertainty of innovative projects through lack of attention, strategic planning and responsibility, lack of management structures with long-term perspectives, uncertainty of state planning policies, lack of cooperation and multilevel communication, lack of cooperation within and between sectors and institutions. Last but not least, is the general population aspect due to the fact that the citizens should be informed and demand innovative changes in order to put pressure on the government and local authorities. However, lack of awareness among the general population is highly observed leading to lack of public demand. Moreover, even when they receive information and knowledge regarding the existing situation, they appear to have a lack of willingness to act and pay due to the aspect of free riding (Roy, 2021; Matsumoto, 2020; Vanderheiden, 2016).

Ellis and Pillay (2017), shed light to the determinants of bankability under the question whether the source of funding is private or public, emphasizing that for the private sector, one of the main factors that will affect their final decision will be profitability and not societal benefits. For that reason, private funding appears to be a not-so-common source of funding for Climate Adaptation Projects since the potential project risks are not always clearly identified and mitigated, especially to the more advanced and transformative projects. A statement made regarding the successful key to bankability is the adequate project preparation, highlighting the lesson learned by water infrastructure development projects that lacked access to climate finance due to limited expertise that would allow the responsible experts to develop bankable projects (Ellis and Pillay, 2017).

A significant barrier identified by Ellis and Pillay (2017), regarding the bankability of a project is the ability to demonstrate a programmatic approach and the potential for a paradigm shift. As mentioned, a transformative and paradigm-shifting potential is context-specific but requires a cross-sectoral approach and national ownership. In order to make a clear understanding of the conditions regarding bankable projects, the authors provided evidence of the water sector proposal of Ethiopia and outlined four main lessons learned. First of all, Important to enabling bankable proposal development, is communication and awareness-raising about GCF procedures among line ministries and other units tasked with the development of climate plans and programs. Secondly, the experts should be able to provide a balanced project proposal. In other words, there is a fine balance between technocratic 'best fit' and pragmatic national priorities. It is often difficult to identify ideas that represent the best fit for both national priorities and those of the founder. The third lesson learned by the Ethiopian case is the fact that a cross-sectoral approach that involves technical staff across various sectors is important when planning and developing project proposals. Finally, is the role of government since it is important

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to ensure that national government experts take ownership of the process of developing proposals, while supporting continued dialogue with external consultants.

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6 Financial solutions

6.1 Categories of Financial Solutions

In the face of accelerating climate change, the requirement for financial solutions that enable effective adaptation strategies is greater than ever before. Regions require assistance to address the barriers to adaptation finance, enhance capacity and, more importantly, design and implement adaptation investment plans that result in bankable adaptation projects. Apart from awareness and strategy in terms of climate actions, the regions need to develop a comprehensive adaptation investment plan which will identify financial sources, funding options and set up monitoring strategies to ensure the funds are deployed efficiently and targeted to region-specific barriers.

Investment strategies related to climate adaptation are inherently associated with high risk and refer to the long-term horizon. In addition, transformative adaptation is contingent on innovative solutions thus exacerbating the risk component. Having said that, it is evident that traditional financial sources including internal regional funds do not suffice for delivering bold adaptation targets. Among the key enabling conditions for successful adaptation and mitigation, the IPCC (2023) underscores "improved access to adequate financial resources, especially for vulnerable regions, sectors, and communities". The report also highlights that the current financial flows attributed to climate change do not suffice for meeting the global climate goals. Smarter adaptation requires smarter adaptation finance, which encompasses innovative instruments, embraces financial technology (fintech) and, above all, is based on cooperation and private-public initiatives (EIB, 2021). EU regions embarking on the adaptation (and resilience) journey depend not only on the mobilization of funds but also on resources that enhance their knowledge, support the design of bankable adaptation projects, and promote innovative solutions for transformation. In that sense, financial solutions encompass advisory services, access to networks, knowledge repositories and hubs, online interactive guidance tools and up-to-date financial technology.

This section explores an array of financial solutions designed to support climate adaptation, categorized into Technical Assistance, Accelerators, Project Preparation Facilities, and Fintech Solutions. These categories encompass a diverse landscape of initiatives and organizations, ranging from investor-led platforms and public-private partnerships to specialized advisory hubs and financial inclusion think tanks. Collectively, they illustrate the multifaceted nature of financial mechanisms available for climate adaptation, each contributing in unique ways to advance both technological and social dimensions of sustainability. In the vast landscape of climate adaptation support services, this section of the report focuses on the specific tools that are earmarked to empower regional authorities in raising and harnessing financial resources for adaptation initiatives.

These solutions, summarized in Figure 16, aim to bridge the existing gaps in climate finance, thereby facilitating the transition to a more resilient and sustainable global economy.

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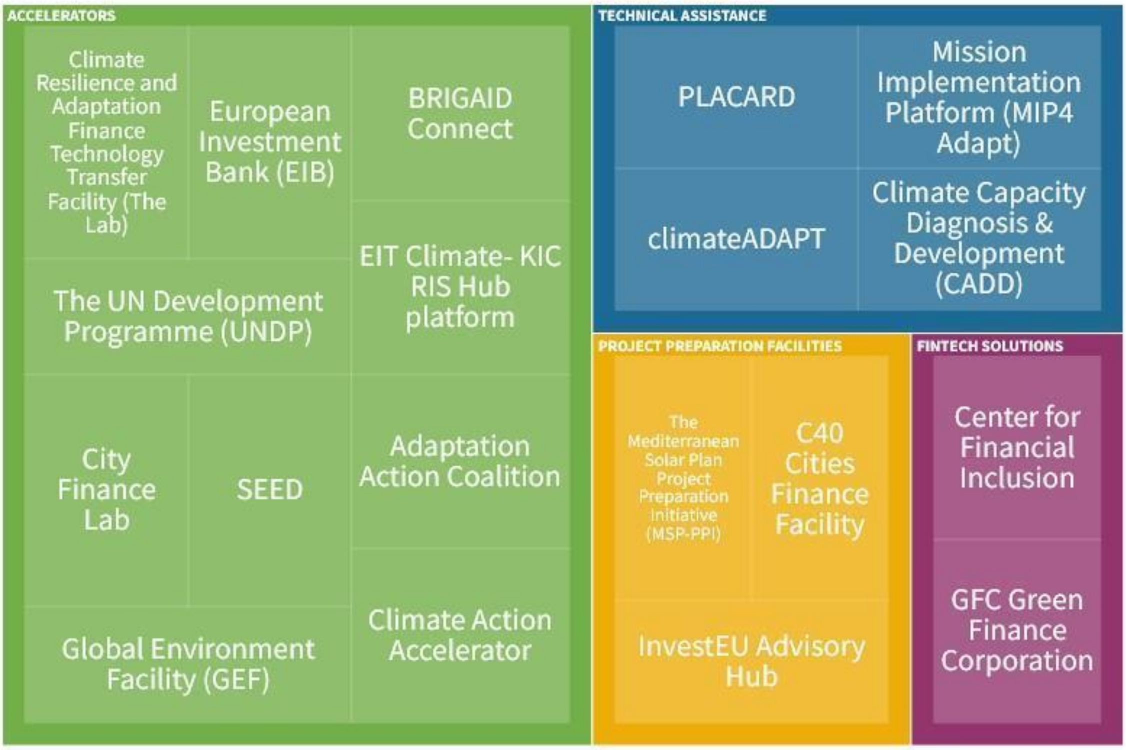
Figure 16: Catalogue of Solutions for Adaptation Finance



6.1.1 Technical Assistance

Technical Assistance, in the context of climate adaptation, refers to the provision of specialized support and guidance to stakeholders, encompassing a range of services from information dissemination to expert advisory roles. It aims to strengthen capacities, enhance knowledge, and facilitate informed decision-making by ensuring that regions, cities, and communities have access to the most recent research, best practices, and insights in the field of climate adaptation. This support is crucial for bridging knowledge gaps and ensuring effective, evidence-based adaptation planning and implementation. In the EU adaptation context, technical assistance is provided in the way of interactive online platforms, which aim to operate as knowledge and connectivity hubs, as well as provide the tools for co-shaping adaptation strategy for regions and cities.

Examples of existing technical assistance platforms include at least the following:

WeAdapt - https://weadapt.org/

WeAdapt serves as an open-source digital platform that facilitates the dissemination of high-quality information on climate adaptation, including the synergistic aspects between adaptation and mitigation efforts. The platform caters to an audience comprised of researchers, policy makers, and practitioners, offering an advisory role. By providing a community space for sharing experiences and lessons learned, WeAdapt contributes to the amalgamation of diverse perspectives and empirical insights, thus acting as a significant catalyst for informed policy formulation and adaptation strategies. Through its vast knowledge pool, it helps regions raise awareness on issues of adaptation finance, such as scientific articles on tools, mechanisms, and financing schemes. Moreover, the platform fosters a large network of stakeholders which the

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regions can reach out to, including development banks, private funds, and climate accelerators with advisory work on climate finance.

The platform also provides training sessions for end-users (which include regions and cities) to build their capacity and utilize climate information in their decision making and help them respond confidently and effectively to climate change. The PROVIA tool, available through the platform, provides guidance, structured along a five-stage iterative adaptation process consisting of:

1. Identifying adaptation needs: Benchmarking the stage of regional development and identifying specific regional needs and barriers, including access to climate finance
2. Identifying adaptation options: The knowledge repository of WeAdapt is leveraged to collate solutions for adaptation and adaptation finance
3. Appraising adaptation options: The solutions underlined in the previous step are evaluated based on user needs and state of development
4. Planning and implementing adaptation actions: Implementation of adaptation plans commences, and steps include project planning, assigning responsibilities, and setting up institutional frameworks.
5. Monitoring and evaluation of adaptation. The process is monitored and evaluated to verify that project planning is followed and that adaptation issues are being tackled.

PLACARD - https://www.placard-network.eu/

PLACARD (PLAtform for Climate Adaptation and Risk reDuction) aims to bridge the gap between Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) communities. Unlike traditional platforms that operate in silos, PLACARD establishes a dialogue and serves as an interchange for knowledge exchange, thereby promoting coherence in research, policy, and practice across these often-fragmented domains. This is particularly crucial given the interconnectedness of climate risks and disaster risks, which necessitate a cohesive approach for effective mitigation and adaptation. Using tools such as storytelling and forward-looking approaches, the PLACARD platform promotes the available tools and initiatives at the EU level in a fashion that is accessible to regions and does not require a high level of specialized skills. Moreover, PLACARD has produced the Connectivity Hub, a dynamic and interactive online visualization tool to help users find knowledge in the form of articles, projects and organizations working on adaptation. Regions can benefit from learning through case studies and best practices in adaptation finance and reach out to organizations and networks that facilitate adaptation finance.

Climate-ADAPT - https://climate-adapt.eea.europa.eu/

The European Climate Adaptation Platform, Climate-ADAPT, is a collaborative initiative between the European Commission and the European Environment Agency (EEA). With advisory capabilities, the platform is maintained by the EEA and is supported by the European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC/CCA). Climate-ADAPT serves as a repository for scientific research and policy documents, thereby offering a consolidated resource for stakeholders to engage in evidence-based climate adaptation planning. It is a multifunctional platform which includes a large knowledge repository on

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adaptation and mitigation, detailed regional and country profiles associated with climate adaptation and mitigation projects, and detailed documentation of EU climate policy.

In addition, Climate Adapt is home to the Regional Adaptation Support Tool (RAST), which assists policy makers and coordinators on the regional level in developing, implementing, monitoring, and evaluating climate change adaptation strategies and plans. It is a practical guidance tool for stakeholders to develop a holistic adaptation strategy including an adaptation investment plan, focusing on creating bankable adaptation projects. The tool is based on a six-step approach to complete regional adaptation pathways:

- Step 1. Preparing the ground for adaptation: Information on regional characteristics, adaptation needs, and current projects is collated, and suitable financing and funding sources are identified, including national sources and EU funding of adaptation, particularly for the adaptation planning process itself.
- Step 2. Assessing climate change risks and vulnerabilities: The region-specific climate hazards are analyzed, and its vulnerability is evaluated based on sensitivity and absorptive capacity.
- Step 3. Identifying adaptation options: A battery of adaptation options can be accessed through the vast knowledge content of the Climate Adapt platform.
- Step 4. Assessing and selecting adaptation options: The diverse set of adaptation options is evaluated based on specific regional needs and barriers using multi-criteria analysis.
- Step 5. Implementing adaptation: Following steps 3 and 4, regional entities move to the implementation of adaptation projects underpinned by a coherent action plan. The platform can be leveraged for consulting experts, finding case studies with a good regional fit and sharing adaptation efforts to ensure a cooperative process.
- Step 6. Monitoring and evaluating adaptation: All actions must be mapped to the needs and barriers identified in the early steps and assessed in terms of meeting adaptation targets and promoting economic efficiency that ensures scalability and replicability.

Mission Implementation Platform (MIP4 Adapt) - https://climate-adapt.eea.europa.eu/en/mission/the-mission/about-mip4adapt

The Mission Implementation Platform (MIP4Adapt) focuses on enabling European regional and local authorities to develop comprehensive adaptation pathways. As an intermediary, MIP4Adapt fosters a Community of Practice and provides technical assistance, thus equipping regions and local authorities with the requisite tools and knowledge to navigate the complexities of climate resilience planning. The platform is aspiring to be the main conduit for promoting the initiatives and projects of the EU Mission on adaptation, hence a powerful tool for regional entities to familiarize with adaptation concepts, learn from case studies and best practices and co-create sustainable pathways for adaptation.

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In terms of adaptation finance, according to the European Commission "the Mission will contribute to mobilizing sustainable finance and resources towards adaptation at scale and closing the climate protection gap. The Mission will help unlock the momentum for climate resilient investments, support the development of insurance products and risk-transfer mechanisms and the development of regional financial risk strategies against climate-related damages and losses".

More importantly, the platform provides technical assistance to regions in a holistic fashion through the Regional Adaptation Support Tool (RAST) , a tool which provides guidance on each of the six main steps that you need to consider during the adaptation planning process. The tool contributes to the design, implementation, and monitoring of an adaptation investment plan for regions along the six steps, firstly by identifying financing sources, including national sources and EU funding of adaptation. The sources are then mapped to the adaptation options that are specific to the region in Step 3 and incorporated in the cost-benefit analysis carried out in step 4. The full-scale adaptation plan is then juxtaposed to the needs and eligibility criteria of the financial sources and instruments that are identified through the knowledge repository of the Mip4Adapta platform. Finally, the RAST provides information and resources for monitoring adaptation projects, which includes evaluating the efficiency of the investment plan, the progress towards climate and financial targets for the region and the necessary re-adjustments regarding, *inter alia*, financial mechanisms and schemes.

6.1.2 Project Preparation Facilities (PPFs)

PPFs play a pivotal role in the climate adaptation landscape by providing the necessary groundwork to transform promising ideas into actionable projects. These facilities offer a structured framework for project conceptualization, feasibility assessment, and financial planning. By addressing technical, environmental, and financial challenges in the early stages of a project's life cycle, PPFs enhance the project's viability, ensuring it meets both sustainability goals and investment criteria. In tandem with national and sub-national actors and financial institutions PPFs contribute to the development of bankable adaptation projects through Project Identification and Design, Capacity Building, direct indirect access to finance, knowledge sharing, monitoring, and evaluation of adaptation projects. Specifically in the field of adaptation finance they play a material part in bridging the gap between solution providers and problem owners through a holistic and project-based approach.

The Mediterranean Solar Plan Project Preparation Initiative (MSP-PPI) - https://www.eib.org/en/publications/mediterranean-solar-plan-project-preparation-initiative

Initiated by the European Investment Bank (EIB) in collaboration with the European Commission, KfW, and the Union for the Mediterranean, the MSP-PPI is primarily financed by the EU-funded Neighbourhood Investment Facility. The MSP-PPI aims to expedite the implementation and financing of projects in crucial sectors such as renewable energy, energy efficiency, and grid connection. By targeting these key areas, the initiative not only addresses the urgent need for sustainable energy solutions but also enhances the financial viability of projects, thereby contributing to the broader objectives of climate resilience and sustainable development.

C40 Cities Finance Facility (CFF) - https://c40cff.org/

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The CFF, a recipient of the UNFCCC award, specializes in preparing climate-relevant infrastructure projects for financial readiness, linking them to appropriate financial resources, and facilitating the replication and scaling of proven approaches and instruments. Focusing on sectors such as mobility, renewable energy, waste management, and nature-based solutions, the CFF goes beyond mere climate adaptation and mitigation by providing ancillary benefits like employment opportunities, improved public health, and social equity. Project development and implementation is a bottom-up process, whereby CFF promotes co-creation with cities' administrations.

The aim of the CFF is to empower cities to prepare finance ready infrastructure projects and to access the most suitable financing solutions, through technical support and targeted studies that provide science-based support for the stakeholders, city-led learning, and training events, on the job-training, demonstrations and deep dives, and stakeholder engagement. The facility focuses on the cities' mitigation efforts, however, provides dedicated support for increasing resilience as well. With respect to adaptation finance, CFF serves as an advisory for the cities by preparing a tailored plan of trainings and workshops to enhance the capability of city administrations to access finance, designing adaptation projects underpinned by financial efficiency and creating the institutional capacity to replicate similar projects in the future.

InvestEU Advisory Hub - https://investeu.europa.eu/investeu-programme/investeu-advisory-hub_en

The InvestEU Advisory Hub serves as a comprehensive facility for the identification, preparation, development, structuring, procurement, and implementation of investment projects. It is an integral part of InvestEU which aims to mobilize more than EUR 372 billion to give an additional boost to investment, innovation, and job creation in Europe over the period 2021-2027.

Specifically, the Hub provides resources for the preparation, development, structuring, procurement, and implementation of investment projects, it targets financial intermediaries to promote financing and investment operations for regions and supports awareness raising and market development activities for investment areas where market failures are manifesting. By doing so, the hub fills a critical gap in the investment landscape, particularly in areas where market failures have inhibited the flow of capital into climate adaptation projects. Although the Hub does not provide immediate financing support, it empowers regional authorities through networking and advisory initiatives that are directly linked to specific InvestEU financial products. Regional stakeholders and city administrations can access advisory support through the Hub's interactive tool by posing a set of questions to identify their advisory needs and the potential advisory partner most suitable to address them.

6.1.3. Accelerators

Accelerators are specialized entities or programs designed to advance the growth and success of innovative solutions, particularly in the scope of climate adaptation. Climate change mitigation and adaptation are expected to be spearheaded by green innovation, new technologies and novel processes. Climate accelerators aim to bridge the gap between research and entrepreneurship since invention is not innovation unless it is commercialized and

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disseminated in the market. The latest IPCC report (2023) underscores that "Enhancing technology innovation systems is key to accelerate the widespread adoption of technologies and practices". Accelerators usually have a strong high-technology focus and do not depend primarily on public funding, thus providing an alternative way for innovative SMEs (and spin-offs) to grow and offer market-ready solutions for climate adaptation.

By providing resources, mentorship, and often direct investment, accelerators bridge the gap between idea generation and implementation. Their aim is to foster rapid development of novel solutions, ensuring they mature from conceptual stages to tangible, impactful projects in a streamlined timeframe. In essence, accelerators act as intermediary institutions, strengthening the national and international entrepreneurship and innovation ecosystems. They facilitate linkages between SMEs and potential markets of suppliers and buyers, leading to the development of innovative products and processes that generate profitability and support scalability. The case for the work of climate accelerators is even stronger in the context of transformative adaptation, which is the focal point of the Pathways to Resilience project.

The Lab – https://www.climatefinancelab.org/

The Lab serves as a platform dedicated to counter climate change in developing nations by employing the collective power of financial solutions, derived from a vast pool of crowdsourced projects. The platform's approach places a heavy emphasis on fostering collaboration between the public and private sectors, ensuring the most innovative and effective projects are financed.

There are specific key criteria on which submitted ideas are assessed and ranked. So, the ideas must be:

- Innovative: Any idea presented needs to be innovative, signifying that it should address challenges in climate finance either unaddressed before or with a more effective strategy than existing market solutions.
- Actionable: The actionable nature of an idea is vital, and The Lab demands evidence of the involvement of skilled entities, a lucid implementation roadmap, and strategies to mitigate potential risks.
- Catalytic: The ability of a concept to mobilise private climate funding, scalability, and potential for replication in many markets are used to assess its catalytic potential.
- Financially Sustainable: Financial sustainability is a cornerstone for any solution, and The Lab expects a transparent plan outlining the phasing out of non-commercial support, even if it's a long-term plan.
- Value Adding: The Lab ensures it adds immense value to the selected teams, complementing their capabilities with its vast resources.

Climate Action and Environment Facility (CAEF) of the European Investment Bank (EIB) – https://www.eib.org/en/about/priorities/climate-action/explained/index.htm

The Climate Action and Environment Facility (CAEF) was initiated by the European Investment Bank (EIB) in 2010 as a dedicated financing source to support climate action and environmental sustainability. Since its inception, it has directed almost €40 billion into projects both within and outside the European Union. These projects range from efforts to reduce GHG emissions and enhancing energy efficiency such as building refurbishments and industrial enhancements to the

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adoption of renewable energy sources like solar and wind installations and preserving the natural environment through better waste management and water sanitation.

Eligibility for the CAEF concerns a wide range of borrowers, encompassing both public and private sectors within the EU and in nations beyond its borders. The EIB works closely with financial institutions throughout Europe to serve citizens and finance enterprises that make cities and regions resilient. This collaboration can provide additional support and opportunities for small and medium-sized companies.

Adaptation Fund Climate Innovation Accelerator (AFCIA) – https://www.adaptation-fund.org/

The Adaptation Fund Climate Innovation Accelerator (AFCIA) under the UN Development Programme (UNDP) aims to invest in and scale early-stage innovations that have the potential to significantly improve resilience outcomes. UNDP, in collaboration with the Climate Technology Centre and Network (CTCN), has allocated $20 million for transformative adaptation action, accessible to 100 countries. With a focus on a diverse set of beneficiaries ranging from governments and NGOs to young entrepreneurs and community groups, the AFCIA offers grants, which can reach amounts up to US$125,000. These grants are reserved for early-stage innovative projects with a significant potential for catalyzing resilience-building outcomes, furthering the goals of sustainable development, peace, and stability.

Delving deeper into the AFCIA's criteria, projects need to encompass three core characteristics: innovation, local leadership, and scalability. This implies that the project should present a novel or enhanced approach to adaptation which hasn't been extensively adopted elsewhere. Moreover, the true essence of the initiative lies in its emphasis on local actors taking the lead in both ideation and execution, while ensuring active community and stakeholder engagement. Scalability is another cornerstone, with the project having the capability to expand its impact or be replicated in varied contexts.

BRIGAID Connect Association - https://brigaidconnect.com/

BRIGAID Connect Association is a cluster of companies that helps increasing Europe's climate resilience through:

- Solutions based on scientific knowledge
- Applied research on EU water and adaptation policy
- Strategic design & creative thinking
- Research on the environment and the economy
- Expertise on EU and national funding schemes

BRIGAID Connect seeks to facilitate the transition of innovative technologies and solutions from development to market readiness. It is a successful Horizon 20202 project turn accelerator, with a special focus on innovative solutions for climate change adaptation. The association aims to bring together research centers, SMEs, and individual experts, contributing from different angles to help increase climate resilience. It addresses the common barriers that innovators face, such as a lack of resources and implementation skills, by connecting them with

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the necessary support. This approach is crucial for expediting the implementation of solutions that make Europe more resilient to climate-induced disasters.

Their work is supported by the Climate Innovation Window (CIW), an online platform that engineers the creation of real networking opportunities between the golden triple helix of innovators, end users and investors. The Climate Innovation Window enables users to browse the innovations database by hazards (coastal floods, droughts, heatwaves, heavy precipitation, river foods, storms, wildfires, and multi-hazards, etc.) and topics (agriculture, disaster and ICT, energy, forests, nature-based solutions, rivers, urban areas, water availability, water quality, water safety, etc.). Maturity of each innovation is assessed through the Technical Readiness Level (TRL), a scale consisting of nine levels where each level characterizes the progress in the development of the innovation, from the initial idea (Level 1) to the full uptake of the product into the marketplace (Level 9). The overarching objective of the Climate Innovation Window is to be a reference portal for innovations on climate change adaptation. Having identified both the potential of innovation undertaken by SMEs in Europe in the field of climate adaptation, as well as the deficit in the commercialization and dissemination of efforts, the CIW aims to develop a marketplace for climate adaptation innovative solutions that will serve as a connector between problem owners (for example regional entities) and solution providers.

EIT Climate- KIC RIS Hub – https://climate-kic-hub-greece.org/

The EIT RIS programme was created by the European Institute of Innovation and Technology (EIT) in 2014 to bridge the innovation gap between European countries, aiming to support the integration of the Knowledge Triangle (business, education, and research) and increase innovation capacity in regions with little pre-established presence to tackle the climate emergency.

The EIT Climate-KIC Regional Innovation Scheme (RIS) is the flagship initiative of the EIT RIS programme, active in Southern, Central, and Eastern European countries where the EIT does not have office structures. Based on the EU Innovation Scorecard, the programme is designed to strengthen the national and regional innovation ecosystems of moderate and emerging innovator countries. It aims to stimulate low-carbon innovation, boost local capacity, reinforce synergies with other innovation initiatives, and target climate mitigation and adaptation needs.

The EIT RIS programme offers skills development, learning, entrepreneurship, and innovation activities to catalyze decarbonization, deliver future-proof jobs, generate new markets aligned to 1.5o, and drive adaptation and resilience.

City Finance Lab (CFL) – https://cfl.southpole.com/

The City Finance Lab (CFL) is an incubator of innovative, replicable, and scalable financing solutions that increase investment in climate-resilient, low-carbon, and green urban projects for sustainable cities. It was launched in 2019 by the Global Infrastructure Basel Foundation (GIB), South Pole, FMDV, and CDP, with the support of the European Institute of Innovation and Technology (EIT) Climate-KIC. It is the first platform in Europe to support the development of innovative financing solutions dedicated to increasing investment in climate-resilient, low-

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carbon, and green urban projects for sustainable cities. It does this by providing cities with technical advisory, knowledge sharing, and capacity building support. It also provides cities with access to a network of potential investors and partners. This can help cities to attract the financing they need to implement their climate action plans.

SEED – https://www.seed.uno/

SEED is a global partnership for action on sustainable development and the green economy. It was founded in 2002 with the support of the United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP), and the International Union for Conservation of Nature (IUCN).

SEED's mission is to promote entrepreneurship for sustainable development, by providing support to small and growing eco-inclusive enterprises (EEEs) in developing countries. EEEs are businesses that generate positive environmental, social, and economic impacts, and SEED provides them with a range of support services, including access to finance and investment, business development support, networking and collaboration opportunities and capacity building and training.

Global Environment Facility (GEF) – https://www.thegef.org/

The Global Environment Facility (GEF) is a multilateral environmental fund that provides grants and blended finance for projects related to biodiversity, climate change, international waters, land degradation, and chemicals and waste. It was established in 1991 as a partnership between 183 countries, international institutions, civil society organizations, and the private sector.

The GEF is the world's largest public funder of global environmental projects. It has provided over $23 billion in grants and leveraged over $129 billion in co-financing for more than 5,000 projects in over 170 countries. Its projects have helped to protect forests, reduce GHG, improve water quality, and reduce the use of toxic chemicals and it has also helped to build the capacity of developing countries to manage their environmental resources sustainably.

Adaptation Action Coalition (AAC) – https://www.wri.org/initiatives/adaptation-action-coalition

The AAC is a state-led initiative with 42 member countries aiming to accelerate adaptation globally and achieve a climate resilient world by 2030. It focuses on driving adaptation action to make communities safer, stronger, and more equitable, aiming to bring major benefits to people and the economy through climate adaptation.

AAC recognizes the need for brave and urgent action to accelerate adaptation, as the current level of action does not match the scale of the climate crisis. Its efforts can help cities and regions towards climate adaptation by providing a platform for collaboration and knowledge sharing among member countries and its state-led approach ensures that governments take the lead in driving adaptation action, which can result in more effective and coordinated efforts at the local level.

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6.1.4 Fintech Solutions

Fintech Solutions, a mixture of 'financial technology', refer to innovative financial tools, applications, processes, and products that leverage modern technology to enhance and streamline financial services. In the domain of climate adaptation, fintech solutions play a key role by offering new avenues of financing, risk assessment, and investment, thus enabling more active and efficient responses to climate-related challenges.

Center for Financial Inclusion - CFI

The Center for Financial Inclusion (CFI) employs a rigorous research-based approach to foster inclusive financial systems, targeting low-income populations who are often excluded from traditional financial services. Founded by Accion in 2008 as an independent think tank, CFI leverages partnerships to conduct empirical research and pilot promising financial solutions. Through its advocacy, CFI aims to promulgate evidence-based policies that extend financial inclusivity to improve livelihoods and contribute to sustainable development. This is particularly crucial in the context of climate adaptation where inclusive financial systems can empower vulnerable communities to invest in adaptive solutions.

GFC Green Finance Corporation - https://greenfinancecorp.com/

Established in 2005, the GFC Green Finance Corporation serves as a financial intermediary that bridges European funding with U.S. clients. Initially focused on solar energy projects, the corporation has diversified its portfolio to include various energy projects in Northern Germany and France, as well as startups since 2015. GFC offers an array of financial services such as crowdfunding, crowd investing, and direct investments, and provides expertise in portfolio decarbonization. By actively involving energy providers, banks, and private investors, GFC demonstrates a collaborative approach to financing that is aligned with sustainable energy management and climate adaptation.

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7 Mapping Barriers to Financing Solutions

Following, we map the specific barriers presented in previous sections to possible finance solutions that can contribute in addressing them. This approach aims to provide policymakers, stakeholders, and practitioners with insights and contribute as a guidance in relevant decision-making processes.

Further, this exercise aims to reveal the levels of suitability and effectiveness that different financial instruments demonstrate in mitigating the multifaceted challenges of regions in overcoming various adaptation barriers.

We assume a 3-scale scoring system, with a Score of 1 indicating a marginal level of suitability, suggesting that the financial solution provides a level of support or mitigation against a specific barrier, but its impact is limited. This might be due to the underlying characteristics of the solution, which are not directly aligned with overcoming the challenges posed by that barrier.

A score of 2 denotes a moderate level of suitability. In this case, the financial solution offers substantial support in addressing the barrier, demonstrating a good alignment of its capabilities with the challenges posed by the barrier.

Finally, a score of 3 implies a high level of suitability, indicating that the financial solution is very well-suited to addressing the specific type of barrier. The solution's features, capabilities, and approach align closely with the challenges posed by the barrier, providing comprehensive support and mitigation.

Table A1 summarizing the mapping results can be found in Appendix I.

The following Sankey diagram (Figure 17) provides a visual representation of the relationship between various types of barriers to climate adaptation financing and the corresponding financial solutions. This diagram explains the flow and intensity of suitability across different categories, offering an intuitive and immediate understanding of how each financial solution aligns with, and addresses, specific types of barriers.

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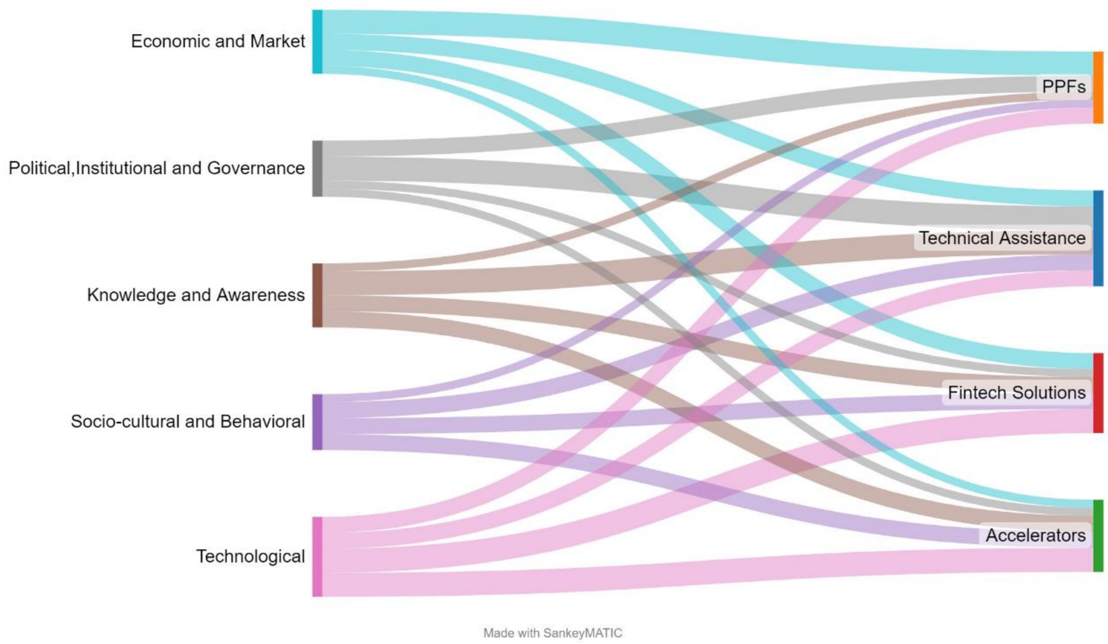
Figure 17: A Sankey diagram displaying barriers against suitable finance solutions



Source: Authors' Calculations

It is important to note that the presented mapping of barriers to finance solutions is not exhaustive and serves primarily as an indicative framework. While it aims to provide a foundational understanding, the complexity and diversity of local contexts may necessitate tailored approaches that deviate from or expand upon the suggested solutions. Therefore, this mapping should be considered as a starting point for further research and contextual adaptation rather than an all-encompassing guide.

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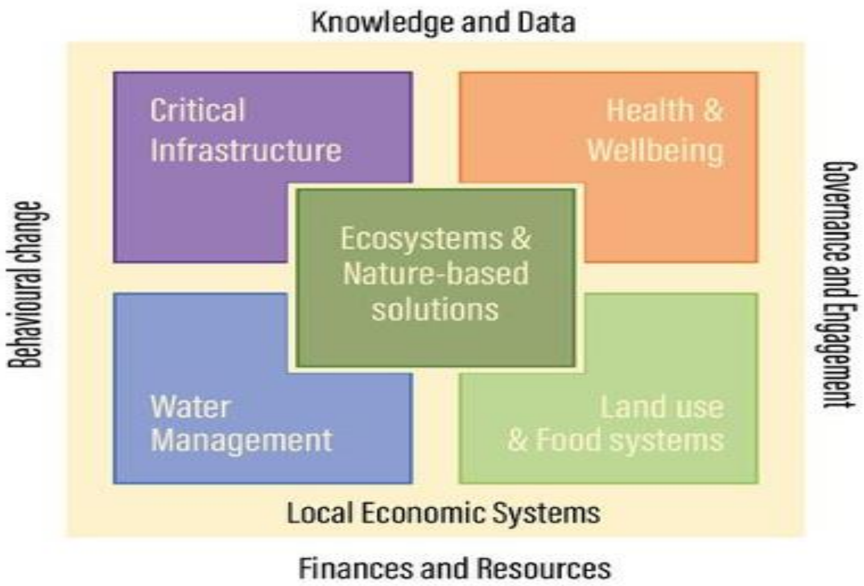
8 Key Community Systems (KCS)

Key Community Systems (KCS), as outlined in the implementation plan of the European Mission for adaptation to Climate Change (Figure 19), represent a vital area of innovation and transformation in the context of climate change adaptation. These systems encompass critical sectors such as ecosystems and nature-based solutions, land use and food systems, water management, infrastructure protection, and health and human wellbeing. The Mission emphasizes the importance of these systems in meeting fundamental human needs while being significantly affected by climate change. By focusing on ecological connectivity, sustainable food practices, water conservation, climate-proof infrastructure, and health resilience, the plan aims to harness nature's power for climate resilience and foster sustainable and secure systems. Additionally, the Mission recognizes the need to adapt local economic systems, highlighting the importance of climate-resilient business models and the re-skilling of professionals to support these key community systems. This comprehensive approach aims to protect vulnerable groups and ensure the overall sustainability and resilience of communities in the face of changing climate conditions.

Figure 18: Mission Adaptation Key Community Systems and enabling conditions



Source: European Commission (2023)

8.1 Barriers across KCS

Considering (KCS), it is important to address all the possible barriers that, based on the relevant literature, may limit the achievement of the objectives of climate change adaptation. For that reason, in this section we briefly map the identified barriers per KCS category as they have been underlined by a great number of researchers. Highlighting and, more importantly, addressing these barriers requires comprehensive strategies that integrate climate resilience into

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community planning, resource allocation, and policy development, while prioritizing equitable access to adaptation measures for all members of society.

8.1.1 Critical Infrastructure

According to Alderson (2019), four main categories of barriers are identified related to Critical Infrastructure. These barriers are focused on the Interdisciplinary nature of CI since they combine the “human” “build” and “natural” aspects, the overemphasis on predefined threat scenarios, the inability to share information about real systems and the lack of understanding resilience itself. More researchers have elaborated their findings regarding the stated barriers. More specifically, a great majority of authors have shed light to the crisis of information sharing and collaboration across corporations and organizations (Petrenj et al. 2013). Some of the main factors for such misinformation or limited information appear in the literature are connected to inadequate communication systems and poor information quality (Drury et al., 2010; Maitland et al., 2009; Schooley and Horan, 2007; Manoj and Hubenko, 2007; Comfort, 2007; Militello et al., 2006; Shen and Shaw, 2004). Following these statements, Drury et al. (2010), Bharosa et al. (2009) and Shen and Shaw (2004), emphasize the top-down crisis management and crisis response regarding the lines of information flows. Moreover, the information is gathered from various sources and integration is carried out in “different actor’s minds'' who may ignore or forget significant information or interpret it differently (Gryszkiewicz and Chen, 2010; Bharosa et al., 2009; Maitland et al., 2009; Netten and van Someren, 2011; Drury et al. 2010).

Additionally, recent scientific literature has underlined elements that may affect the information sharing among organizations due to language issues, such as different vocabulary, technical terms or complete language, organizational structure, for instance lack of coordinated concept of operations, procedures and processes, in terms of different degree of standardized and institutionalized roles and process for dealing with other participants, technology, resources and skills, such as different incompatible communication systems on use and data stored in different ways, and culture knowledge and experience, due to different cultural rules, practices, norms and knowledge constrain ability to information sharing (Drury et al., 2010; Bodeau et al., 2009; Asplund et al. 2008).

Another factor mentioned regarding information sharing is the lack of trust, since information sharing may lead to business advantage loss (Asplund et al., 2008). This factor is also connected to poor security (Drury et al., 2010). Finally, unbalanced workload distribution across actors may lead to excess workload to some participants and 012007; Militello et al., 2006)

Moving forward, when discussing climate change adaptation and resilience, it is crucial to take into consideration the threats that may affect CI. Osei-Kyei et al. (2021) categorized those threats into 8 groups of possible hazards, including environmental, social, political, managerial, technical, operational, financial, and generic. All those groups have been thoroughly analysed by a vast number of researchers. More specifically, environmental threats are focused on natural disasters (Ansell et al., 2010; Hurst et al., 2014b; Huang and Fan, 2011; Bartnes and Moe, 2017; Espada et al., 2015; Hurst et al., 2014a; Burgess, 2007; Klügel, 2016; Rehak et al., 2018; Siergiejczyk and Dziula, 2015; Li et al., 2009; Masera et al., 2009; Zhang et al., 2015; Michel-Kerjan, 2003), ageing and decay (Hurst et al., 2014b; Merli et al., 2018; Bartnes and Moe, 2017; Espada et al., 2015), lack of available land (Espada et al., 2015), contamination (Ansell et al., 2010; Hurst et al., 2014b; Li et al., 2009; Zhang et al., 2015). Similarly, social threats include cyber

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threats (Armbruster et al., 2013; Hurst et al., 2014b; Chen et al., 2009; Osei-Kyei and Chan, 2015; Pathirage and Al-Khaili, 2016; Bie et al., 2017; Yi and Wang, 2013; Tidwell et al., 2019; Bartnes and Moe, 2017; Hurst et al., 2014a; Rehak et al., 2018; Siergiejczyk and Dziula, 2015; Zhang et al., 2015), terrorist attacks (Ansell et al., 2010; Ongkowijoyo and Doloi, 2017; Ouyang, 2014; Alcaraz and Zeadally, 2015; Bartnes and Moe, 2017; Espada et al., 2015; Hurst et al., 2014a; Siergiejczyk and Dziula, 2015; Li et al., 2009; Masera et al., 2009; Abou El Kalam et al., 2009), thefts (Armbruster et al., 2013; Li et al., 2009), war (Ansell et al., 2010; Zhang et al., 2015), concentration of population in urban areas (Armbruster et al., 2013). Political threats are focused on political unrest (Alcaraz and Zeadally, 2015; Li et al., 2009), and absence of national government legislation and initiatives on disaster management (Ansell et al., 2010), while managerial threats include uncertainties about the source of evolution and possible solutions of a failure/disruption (Ouyang and Fang, 2017; Siergiejczyk and Dziula, 2015), decrease in capacity (Ouyang and Fang, 2017; Novelo-Casanova and Suarez, 2012), lack of interconnected preparedness (Huang and Fan, 2011), ineffective response to threats (Ouyang and Fang, 2017) and ineffective communication with the public (Hurst et al., 2014b; Li et al., 2009; Zhang et al., 2015).

Regarding technical threats, the main three factors that have been raised in the literature review are the unclear responsibility, lack of experience and issue of power and trust (Laugé et al., 2015; Novelo-Casanova and Suarez, 2012), the unavailability of personnel (Novelo-Casanova and Suarez, 2012) and finally conflicting interests (Novelo-Casanova and Suarez, 2012). One of the last groups that have been analysed is the possible financial threats including financial challenges, such as economic downturns and no revenues for maintenance (Merli et al., 2018; Banerjee et al., 2018) as well as interest rate instability (Ouyang and Fang, 2017) and exchange rate instability (Armbruster et al., 2013). Finally, generic threats have been underlined such as cascading failures in a way that the disruption or failure of a single Critical Infrastructure may lead to cascading effects in other CIs (Baecher, 2006; Thedeen, 2006; Wilson et al., 2014; Osei-Kyei and Chan, 2015; Bie et al., 2017; Laugé et al., 2015; Alcaraz and Zeadally, 2015; Espada et al., 2015; Burgess, 2007; Rehak et al., 2018; Siergiejczyk and Dziula, 2015; Masera et al., 2009). Another factor raised is the supply shortage which could negatively impact normal operation of CIs (Hurst et al., 2014b; Hurst et al., 2014a) and finally, the loss of customers in a case where customers who may be disrupted by CI failures might face direct losses and as a result loss confidence (Hurst et al., 2014b)

8.1.2 Health and Well-being

When focusing our interest on the health and well-being aspects, literature review has established essential psychological barriers that may affect the process of climate change adaptation. Gifford (2011) emphasized the psychological barriers observed to behavioural change, mentioning them as obstacles to carbon-neutral climate change mitigation and adaptation. Over the years, 29 factors have been analysed under the umbrella of psychological barriers which have been grouped into 7 main categories. Limited cognition is the first psychological barrier category analysed by researchers (Simon, 1957; Tversky and Kahneman, 1974) a category which includes seven factors such as ancient brain (Ornstein and Ehrlich, 1989) which underlines that the human brain is willing to evolve and keep up with the new condition of climate change, but this evolution is happening at a slow pace. The second factor is ignorance (Dietz et al. 2009; Gardner and Stern, 2008; Bord et al. 2000) both for the existence of the problem as well as the fact that a large amount of the global population is characterized by lack

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of knowledge regarding climate change, its causes and impacts. Environmental numbness as a phenomenon outside of immediate attention because it is not causing any immediate personal difficulties (Gifford, 2011; Gifford, 1976). Uncertainty about the outcomes of climate change as well as the outcomes of the efforts to prevent or eliminate climate change is another element that slows down the adaptation process (de Kwaadsteniet, 2007; Hine and Gifford, 1996; Budescu et al, 2009). Other issues raised regarding limited cognition is judgmental discounting (Gifford, Scannell et al. 2009; Uzzell, 2000; Musson, 1974; Hendrickx and Nicolaij, 2004; Gattig and Hendrickx, 2007) as well as optimism bias which may be a positive aspect in general, however, excess optimism can discount personal risks (Simon, 1981; Weinstein, 1980; Weinstein et al. 1988; Hatfield and Job, 2001; Pahl et al. 2005). The last factor that is included in the limited cognition category is the perceived behavioural control/self-efficacy since the individuals assume that they can do nothing to eliminate the climate change impacts due to the fact that climate change is a global phenomenon (Ajzen; 1991; Huebner and Lipsey, 1981; Heath and Gifford, 2002; Kaiser and Gutscher, 2003; Lorenzoni et al., 2007; O'Connor et al., 1998).

The next broad category of psychological barriers is ideologies which mainly includes four significant factors worldviews with the emphasis given to capitalism and the lifestyle created for millions of people globally (Heath and Gifford, 2006; Hardin, 1968; Dunlap and McCright, 2008), superhuman powers and more specifically the humans' beliefs (religious or not) regarding the fact that individuals should take little or no climate-related actions since God or Mother Nature will do what it wishes. (Mortreux and Barnett, 2009). Another factor appears to be "techno-salvation" since overconfident beliefs in the efficacy of technology appear to serve as a barrier to their own climate-mitigating behaviour (Gifford, 2008; Terwel et al., 2009; Simon, 1981; Lorenzoni et al., 2007). According to Mahmud (2015), the term "techno-salvation" is described as a mutation of two words "salvation" and "technology" which anticipates the technological advances to create a heaven on earth before transcendent mind escapes this earth. Additionally, Feygina et al. (2010) have described the tendency to defend and justify the societal status quo as system justification, when citizens are fortunate enough to have a comfortable lifestyle and prefer to not change the way things currently operate.

Comparison with others is mentioned as another main category of psychological and behavioural barriers because people tend to follow social norms and networks (Thøgersen, 2008; Schultz et al., 2007; Rogers, 1983), social comparison (Festinger, 1954; Heath and Gifford, 2002; Ajzen, 1991; Stern, 2000; Biel and Thøgersen; 2007; Cialdini, 2003) and last but not least, perceived inequity (Kerr, 1983; Olson, 1965; Aquino et al., 1992; Gifford, 2011). Besides comparison with others, humans tend to take into consideration sunk costs since frequent changes in their habits and behaviours will distract them from their real goals resulting in their lives going off schedule and more effort needed for goal achievements (Cunha and Caldieraro, 2009; Leahy, 2009). The three main aspects that align with sunk costs are financial investments (Arkes and Hutzel, 2000; Knox and Inkster, 1968; Reser, 1980; Festinger, 1954; Skinner, 1987), behavioural momentum (James, 1890; Ouellette and Wood, 1998; Hobson, 2003; Maio et al., 2007; Nevin et al., 1983; Bamberg et al;, 2003; Carrus et al., 2008; Matthies et al., 2006; Fujii and Garling, 2003) also called habit or "the enormous fly-wheel of society" by James (1890, p.121) which appears to be a positive aspect, however, in the context of climate change is not a significant barrier but is less favourable actor especially when mitigation of climate change is taken into consideration. Furthermore, conflicting values, goals and aspirations may be recognized as another barriers since each individual have multiple goals and values, which may

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not be compatible with climate change mitigation (Lindenberg and Steg, 2007; Nordlund and Garvill, 2002; Schwartz, 1992; Stern; 2000; Vining and Ebreo, 1991; McCright, 2009; Nilsson et al., 2004; O'Connor et al., 2002).

Moving forward, researchers shed light to discordance as a significant element of psychological barriers summing up the negative thoughts and views of others ranging from lack of trust to denial of following others' advice Mistrust is one of the main factors regarding discordance since trust is a crucial element for a healthy relationship even between citizens and authorities (Brann and Foddy, 1987; Foddy and Dawes, 2008; Terwel et al., 2009). Over and above that, since policymakers have considered and implemented many voluntary programs related to climate-friendly behaviour choices, which are mainly ignored by individuals because they assume the programs are not good enough to participate. This perceived program inadequacy has been underlined by Pelletier et al., 1999. Another crucial element to mention is the fact that uncertainty, mistrust, and sunk costs may influence people to adopt denial of the existing problem (Norgaard, 2006; McCright and Dunlap, 2010). A significant finding is the fact that a great majority of individuals tend to ignore or strongly react to the policy, advice or directions provided by scientists and authorities in a form of protest against their freedom. This form of reactance has been highlighted by many researchers (Earle, 2004; McGregor et al., 1994; Brehm, 1966; Eilam and Suleiman, 2004; Newport, 2010; Hoggan, 2009; McCright, 2007; Oreskes and Conway, 2010).

Individual psychology may also be affected by perceived risks related to peoples' attempt to follow climate-friendly related approaches, such as reducing greenhouse gas emissions, which are influenced by six significant factors (Schiffman et al., 2006). Gifford (2011) indicated the functional, physical, financial, social, psychological, and temporal risk as the most known and significant. The analysis of barriers connected to psychological and behavioural aspects and therefore health and well-being is concluded with limited behaviour, which is the last category that has been analysed in the literature. Individuals tend to take limited to no action in order to minimize greenhouse gas emissions and the two factors that are attached to that behaviour is tokenism and rebound effect (Diekmann and Preisendorfer, 1992; Kempton et al., 1985; Jevons, 1865; Brookes, 1990; Khazzoom, 1980; Joireman et al., 2009).

8.1.3 Water Management

The case of waste management barriers is analyzed based on different points of view by researchers. Different schools categorize the existing barriers based on specific characteristics. Judd et al. (2023) provides evidence based on research done through questionnaires with 110 responses of people managing environmental water throughout Australia, from which five main categories for water management barriers were defined. Starting with the knowledge aspect, responders provided evidence of factors such as uncertainty how ecosystems will respond on proposed measures and solutions regarding water management solutions, limited availability of usable, local information on the field of analysis, uncertainty about which climate change scenario to choose and where to start and finally siloed approach to environmental water management. The next category of defined barrier is connected to policy and legislation where factors such as current legislations do not take into consideration climate change, and legacy land use and water sharing arrangements that need to be addressed where possible.

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The next barrier appears to be a more practical category referring to planning and monitoring where responders provided evidence on the fact that planning occurs predominantly on an annual time scale as well as planning occurs on a single river basis proposing to expand the planning procedure to a broader scale. Moreover, the responders mentioned the lack of monitoring information for adaptive water management by improving the auditing and monitoring of environmental deliveries against ecological objectives. Another important category of water management barrier is the legitimacy where two significant issues were raised regarding lack of confidence from managers in climate and hydrology predictions as well as lack of public support proposing to encourage greater collaborations between researchers and users, communicate errors of margin and uncertainties in predictions and improve communication of the benefits of environmental water.

Finally, the responders indicated the political and governance aspect, a category in which the well-known and often-observed factor of lack of political leadership is highlighted. Of course, the issue of current water governance arrangements where organizational responsibilities is not well-defined. Furthermore, conflicting objectives for organizations managing water and lack of staff and funding were emphasized.

Azhoni et al. (2018), on the other hand provided another approach in which they divided the water management barriers were categorized in two phases barriers at the understanding phase and barriers at the planning phase, with the first category focusing on the unavailability and/or inaccessibility of information and knowledge, legitimacy, credibility, trust and receptivity to the information and willingness and ability to use it. The second category includes factors such as leadership roles regarding authority, the ability to identify risks and opportunities, assess and devise alternative adaptation strategies and build consensus, and of course credibility and trust.

8.1.4 Land use and Food system

Moving to the next Key Community System, Boehnke et al. (2023) provided evidence of barriers in municipal land use planning. Their outcomes indicated the following three main categories of barriers: organizational-structural barriers, procedural barriers, and legal barriers.

Focusing on the organizational-structural barriers, In the administrative system, each department or division regulates a specific area as well as lively cooperation between different departments is not part of the planning culture. Additionally, interdepartmental cooperation is hindered by differences in the political leadership of the departments or personal differences between the heads or mayors and the planning is carried out for too long and too concretely in a single department alone. Moreover, there is no control during and/or after construction to check whether the defined measures have been implemented. Internal professionals with a mandate for environmental or climate issues demand too much or too vehemently and are not willing to compromise – causing problems for all other interests.

The procedural barriers provide evidence regarding climate experts not been part of the planning department as well as not being specifically responsible for climate issues. Unclear and/or ungiven responsibilities for different adaptation fields and measures in the different departments are highlighted. In planning offices, habitual patterns of action, procedures and certain networks among colleagues develop over time and in the planning process, it is still largely unclear when individual adaptation measures should be considered, and which other departments should be informed (with or without a climate expert).

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Regarding the legal barriers, the authors indicated issues such as climate protection and adaptation as well as air pollution control are represented by other fields and legal bases and planners stumble with the decision for significance and with the question, whether the expenditure for the expected improvement effect of an adaptation. If the impact on local climate is not significant, it is legally sufficient to mention or describe climate issues in the relevant reports. Another significant issue raised refers to the basic right to ownership and freedom of construction enshrined in the Basic Constitutional Law. This freedom can only be restricted if there is good justification and professional evidence.

8.1.5 Nature-based solutions

Nature-based solutions (NbS) hold significant potential for ramping up climate adaptation efforts within the EU by leveraging the continent's diverse ecosystems and natural resources. By restoring and enhancing natural habitats, such as wetlands, forests, and coastal ecosystems, NbS can provide multiple benefits, including flood protection, carbon sequestration, and biodiversity conservation, thereby contributing to both climate resilience and ecosystem restoration goals. NbS can prove to be far more cost-effective compared to traditional infrastructure projects, thus elevating their prominence in the field of climate adaptation solutions (EEA, 2021). Their unique characteristics and lower cost constitute them a viable option for vulnerable regions and regions facing significant financial constraints, hence the EU has identified their potential role in realizing socially inclusive green growth (European Commission, 2015). In addition, NbS interact with other Mission KCS, as they can be incorporated into urban planning, agriculture, water management, and coastal protection strategies.

Nevertheless, despite their potential, several barriers impede the flow of adaptation finance toward NbS initiatives. One significant economic and market barrier is the lack of robust financial mechanisms tailored specifically for NbS projects. Toxopeus & Polzin (2021) identify two general barriers applicable to all types of NbS, namely (i) poor coordination across public and private financiers for urban NBS and (ii) knowledge gaps regarding valuation and accounting for the multiple benefits of urban NBS. EIB (2023a) underscores the issue of communication barriers especially manifesting in landscape-scale projects involving multiple land uses or urban projects involving a wide array of public entities. Valuation issues tend to increase the inherent uncertainty of NbS adaptation projects and distort investor incentives. Adams et al. (2024) highlight the deficiencies of local public authorities to develop spatially dedicated data which could be leveraged to gauge the potential impact of NbS and inform the cost-benefit analysis. Moreover, the long-term benefits associated with adaptation investment are more pronounced in the case of NbS, channeling risk-averse investors to other types of projects. Considering private investment for NbS, the extended timeframes required for financial returns (for example, from carbon revenues) combined with high transaction costs (project research and administration costs) significantly deter private financing (EIB, 2023a).

Having said that, it is not just the private sector that suffers from short-termism. Kabisch et al. (2016) note that local public authorities often make myopic investment choices and suffer from decreasing staff and subpar expertise in environmental management. Furthermore, regional, and municipal authorities are inclined to favor projects contributing to economic growth, with real estate and construction yielding fast and tangible results (Koppenjan and Enserink, 2009).

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Given the fact that the construction sector is expected to recover first after periods of recession, it has gained prominence especially in crisis-hit European regions, sidelining NbS.

In conclusion, numerous barriers for adaptation finance manifest in an even more pronounce fashion around NbS, mostly (but not exclusively) due to the fact that thy represent a relative novelty in climate adaptation strategies for regions. Addressing these institutional and policy barriers is essential for unlocking the full potential of NbS in climate adaptation and securing the necessary finance to support these initiatives.

Box 2: Barriers to Adaptation Finance across KCS

Distinct types of barriers to adaptation finance outlined in 5.1 manifest across the Mission KCS. Although certain financial barriers are common (e.g. increased uncertainty associated with adaptation investments in each one of the KCS), the characteristics and intensity of barriers varies between the five KCS, pertaining to the different structural characteristics and involved stakeholders. This section attempts a first tier linking of the broad types of adaptation finance barriers with the KCS to underline the ways in which they arise in each category, through indicative examples.

1. **Critical Infrastructure**

   Infrastructure projects, which are material in the Adaptation process for every region, face significant E**conomic and Market** barriers. Apart from the overarching obstacle of high uncertainty associated with adaptation finance, increases in interest rates (supporting monetary policy mandates at the national or EU level) are far more critical for climate projects. Furthermore, **Technological Barriers** including lacking technical expertise of the private sector and the scarcity of high-technology enterprises providing innovative solutions has a detrimental effect on implementing bankable infrastructure projects.

2. **Health & Well-being**

   Due to the sometimes-indirect fashion that climate change affects health and well-being (excluding natural disasters and extreme events), other sectors are prioritized for adaptation funding thus raising a non-negligible E**conomic and Market** barrier. Having said that, many adaptation projects in the health and well-being field yield multiple benefits beyond climate resilience, such as improved healthcare access,

Box 2: Barriers to Adaptation Finance across KCS (cont.)

   enhanced community resilience, and economic development. Nonetheless, these are not integrated in cost-benefit analyses for adaptation projects revealing a string presence of **Knowledge and Awareness** barriers.

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3. **Ecosystems & Nature-based Solutions**

   Socio-cultural and Behavioural barriers are highly relevant, as low levels of public awareness on the efficiency on NBS impede their adoption. In addition, in the field of **Knowledge and Awareness**, the non-market value of ecosystem services remains elusive for the largest share of the population (across all educational levels). Hence, the urgency of fostering climate and ecosystem services is not prioritized in financial planning.

4. **Water Management**

   Strong demand from the agricultural and industrial sector, along with prioritization of meeting production targets poses an E**conomic and Market barrier** for sustainable water management across EU regions. **Knowledge and Awareness** deficits affect adaptation actions on water management as it is challenging to inform the public regarding the necessary transformations in this sector. Moreover, these barriers intersect with **Socio-cultural and Behavioural barriers,** primarily the unwillingness to change unsustainable water use and consumption patterns.

5. **Food & Land-use Systems**

   Persistence of unhealthy dietary and food consumption habits represents a critical **Socio-cultural and Behavioural barrier**, which can thwart efforts to climate-proof food systems. Having said that, land-use and agricultural actors face sizable **Technological Barriers**, as innovations in this area are harder to disseminate due to the heterogeneity of agricultural practices, landscapes, and farm sizes. Finally, vested interests in the agricultural and food sector antagonize environmentally sound practices and policies in many cases, highlighting a non-negligible **Political, Institutional and Governance barrier.**

8.2 Adaptation Finance Solutions Mapping on KCS

8.2.1 Ecosystems and nature-based solutions & climate adaptation and resilience

Resilience and climate adaptation can be improved using ecosystems and nature-based solutions. Pathak (2022) argues that these solutions have several advantages, such as enhanced water and air quality, sequestration of carbon dioxide, and biodiversity preservation. This strategy helps ensure a more sustainable future while meeting pressing environmental concerns. Key (2021) highlights the 'triple win' that these solutions provide by supporting biodiversity, ecosystem health, and climate change adaptation at the same time.

In urban contexts, the effectiveness of combining grey (traditional engineering), green (natural and semi-natural areas), and blue (water-related) infrastructure is noted by Depietri (2017). This hybrid approach is particularly beneficial for disaster risk reduction and climate change adaptation, underlining the critical role of ecosystem health and resilience. Kabisch (2017)

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points out that the success of such strategies heavily relies on the robustness of ecosystems, which can be fortified through nature-based solutions (NbS).

Pramova (2012) brings an important perspective on social dimensions, highlighting how ecosystem-based adaptation, particularly through forests and trees, can reduce social vulnerability to climate hazards. The importance of ongoing monitoring and evaluation of these adaptation strategies to ensure their success and effectiveness is underscored by Morecroft (2019). Lastly, Dudley (2010) identifies protected areas as key players in emission reduction and the sustenance of ecosystem services, thereby aiding communities in coping with climate change impacts. These insights collectively underscore the critical role of ecosystems and nature-based solutions in fostering resilience and adapting to climate challenges.

8.2.2 Land-use and food systems & climate adaptation and resilience

Land-use and food systems are integral to the dialogue on climate adaptation and resilience, with strategies for climate-resilient agriculture being a central matter. Sustainable production methods and fostering regional diversity are among the key strategies to enhance the adaptive capacity of agricultural producers (Webb, 2017; Lengnick, 2015). These approaches not only aim to protect producers against climatic shocks but also to ensure the sustainability of food production systems in the face of environmental degradation (Bullock, 2017).

The role of management decisions in agriculture is crucial, encompassing practices like carbon and nitrogen management. According to Handayani (2021) and Lal (2011), these practices contribute significantly to mitigating climate change impacts while also promoting soil and water conservation. Such measures underline the importance of integrating environmental accountability with agricultural productivity. Vermeulen (2012) suggests that supporting agriculture and food security under the threat of climate change requires accelerated adaptation and improved management of agricultural risks. This includes a proactive approach to addressing the vulnerabilities of food systems to climate variability. However, adapting agricultural and food systems to climate change has challenges. Antle (2010) points out that adaptation involves a mix of private and public investment decisions, which are further complicated by climate and policy uncertainties. This underscores the need for a strategic approach that balances immediate adaptive needs with long-term sustainability goals, ensuring food systems are resilient in the face of changing climate conditions.

8.2.3 Water management & climate adaptation and resilience

Water resource management is crucial for climate resilience. Gain (2013) argues that Integrated Water Resources Management (IWRM) can improve adaptive capacity by reducing vulnerability and enhancing resilience to climate change, which stresses the need for coordinated development and management of water, land, and related resources to maximize economic and social welfare while protecting vital ecosystems.

Wilby (2020) emphasizes the importance of managing resilience in water systems at different levels. Developing indicators to track changing climate risks and socio-ecological responses is essential for effectively dealing with and adjusting to these challenges. In the agricultural sector, Water Saving Irrigation (WSI) is seen as a crucial tactic for improving resilience to climate change. Zou (2011) underscores WSI's advantages of cutting CO_2 emissions and preserving water, underscoring its importance in the wider scope of sustainable water management. Miller (2014) promotes a holistic and multi-criteria approach to water resource management and climate change adaptation. This approach considers the interconnected nature of water systems

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and their environments. Matthews (2009) underscores the significance of vulnerability and resilience assessments in water management strategies to address climate change challenges.

The flexibility of water resources management practices is highlighted as crucial for effectively addressing climate change impacts (Stakhiv, 1994) and Bergkamp (2002) emphasizes the need for an adaptive management approach specifically designed to deal with the unique challenges brought by climate change on water resources.

8.2.4 Infrastructure protection & climate adaptation and resilience

The protection of infrastructure and its adaptation to climate change effects is becoming a key part of the strategy to face these growing challenges. The use of cutting-edge digital tools, like the Internet of Things (IoT) and Artificial Intelligence (AI), is making a big difference in making our critical systems more robust. Argyroudis (2022) discusses how these innovations help in quickly assessing situations and making informed decisions, thus enabling us to react swiftly to climate-related dangers.

Regarding Transportation, Hayes (2019) calls for a new way of thinking that includes principles of resilience that consider both social and ecological factors in the design of this infrastructure, which not only makes transportation networks more adaptable to climate changes but also less vulnerable to them. Gupta (2018) points out the crucial role of using data to pinpoint vulnerabilities within these networks. This kind of analysis lays a strong foundation for identifying risks and crafting effective strategies to cope with them.

Green infrastructure is also key to making our cities stronger in the face of climate change. Urban green spaces and water systems can cool cities naturally, manage water better, and support diverse plant and animal life (Pitman, 2015). Langridge (2014) highlights the importance of including natural elements like coastal ecosystems in our climate adaptation plans, which not only helps protection against the impacts of rising sea levels and storms but also takes advantage of the natural protective features of these ecosystems.

8.2.5 Human health and well-being & climate adaptation and resilience

The consequences of climate change on people's health and happiness are profound and widespread, hitting the most vulnerable communities the hardest. Research, including findings presented by Berry (2018) and insights from the Zimbabwe Human Development Report (2017), highlight how these effects are complex, touching on every aspect of human life - from our physical health to our mental and spiritual well-being. These issues are further complicated by weaknesses in existing healthcare systems, adding to the daunting nature of tackling these problems.

The complex ways in which climate change affects our health demands creative and comprehensive solutions for adapting. Havea (2018) emphasizes that the repercussions extend beyond just physical health, impacting mental and spiritual health as well, pointing to the necessity for strategies that consider the whole spectrum of human health. Bowen (2013) suggests a detailed governance model that incorporates insights from social sciences to guide health adaptation efforts. This approach calls for a more inclusive strategy that goes beyond the usual limits, highlighting the need for cooperation across different sectors and encouraging community involvement in creating and applying adaptation initiatives.

Ebi (2008) and Bowen (2013) also stress the importance of including a variety of viewpoints and knowledge in planning for adaptation. This involves recognizing and utilizing the wisdom and practices of local communities, which can provide essential insights for crafting effective and

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culturally sensitive adaptation methods. By involving these communities, strategies can be better aligned with local needs and situations, thereby boosting the resilience of these groups by enabling them to actively confront the health challenges posed by climate change.

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Box 3: Adaptation Finance Solutions and KCS

Adaptation efforts for all mission KCS can be catalyzed with the work of dedicated platforms, project preparation facilities and accelerators as the ones outlined in section 6.1. Nonetheless, specific attributes in these solutions can cater to specific needs for KCS as listed in this Box:

1. **Critical Infrastructure**

    - The **InvestEU Advisory Hub provides** nuanced solutions for the complex planning and financial structuring associated with large-scale infrastructure projects
    - **BRIGAID-CONNECT** offers numerous innovative solutions through the CIW through dedicated categories in the "Areas" section for Buildings and in the "Solutions" section for Engineering and Built Environment
    - **WeAdapt** hosts numerous case studies and success stories form around the globe through an interactive map

2. **Health & Well-being**

    - **Climate-ADAPT** offers access to the latest research that is essential for adapting health systems and public health policies to climate-related challenges
    - The **Center for Financial Inclusion** promotes inclusion strategies, crucial for funding and implementing health and well-being projects, especially in low-income regions

3. **Ecosystems & Nature-based Solutions**

    - The **InvestEU Advisory Hub** assists with plans to incorporate nature-based solutions into traditional infrastructure
    - **PLACARD** offers a bevy on informational modules through the Connectivity Hub, where regions can have access to academic papers, case studies and networks operating in the field of Nature-based solutions
    - **BRIGAID CONNECT** CIW hosts a dedicated are for Nature-based Solutions in its search engine to promote innovative and ready-made solutions in the field

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Box 3: Adaptation Finance Solutions and KCS (cont.)

4. **Water Management**

    - **CFL** supports innovative financing solutions dedicated to increasing investment in climate-resilient and green urban projects
    - **BRIGAID CONNECT** CIW hosts a dedicated are for Water Management in its search engine
    - **C40 Cities** has experience in financing adaptation projects related to water management in developing countries (Malaysia, South Africa)

5. **Food & Land-use Systems**

    - **EIT Climate- KIC RIS Hub** helps to the adoption of innovative practices in agriculture and land use, aligning them with climate adaptation and sustainability goals
    - **MIP4Adapt** provides access and information to a bevy of successful projects related to food safety and adaptation solutions in the agri-food sector
    - **WeAdapt** hosts numerous studies and opinion articles on food security and sustainable transformation in the AFOLU sector

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9 Conclusions

Mobilizing financial resources for Climate Adaptation is of perennial importance if the world, and the EU in particular, aim to tackle climate change and foster the green transformation envisioned by the EU Green Deal and the Paris Agreement. Despite the increased awareness on the issue and the scaling up of financial resources over the past decade, there is still a lot of ground to cover, especially regarding adaptation finance. Although coordinated efforts from government, international institutions, industry, and the research community have contributed to the surge of adaptation finance, global funds dedicated to climate adaptation account for less than 5% of climate financial flows. Having said that, the lion's share of adaptation finance is conducted by the public sector and national or international financial institutions. Bolstering adaptation efforts and delivering bankable projects warrants both ramping-up of total financial resources and the increased participation of the private sector, both in terms of financing as well as implementing adaptation projects. Scaling-up and blending adaptation finance is crucial especially if the target is to deliver transformational adaptation. In this process, identifying the key structural barriers for adaptation finance (attracting and efficiently using financial resources) is of material importance.

This report has focused on the barriers for adaptation finance that regions face based on a thorough review of the literature. n examining the intricate landscape of adaptation finance within the European Union (EU), it becomes evident that while significant strides have been made, numerous barriers persist, hindering the effective mobilization and allocation of resources crucial for climate adaptation efforts across EU regions. We have considered explicit and implicit barriers and acknowledged the material role of regional capacities both for mustering necessary financial resources and for leveraging funding for efficient adaptation projects. We classify barriers into five broad groups, namely (i) economic and market barriers, (ii) socio-cultural and behavioral barriers, (iii) knowledge and awareness barriers, (iv) technological barriers, (v) political and institutional barriers. These barriers and capacity deficiencies manifest in diverse ways depending on the nature of the adaptation process, the sector financing and conducting adaptation strategies and the scope of adaptation. Highlighting the need for transformational adaptation in the EU, we posit that cooperation issues across diverse actors, inadequate (or absent) regional innovation systems and lack of political will are, inter alia, the biggest impediments. The literature review is enhanced with the most recent data at the EU NUTS2 level, which reveal the significant divergence in all categories of barriers and capacity across EU regions. The latter underscores the need for tailored approaches and a sizeable degree of co-designing adaptation projects with regional stakeholders to address the specificities at the regional level.

However, despite these formidable challenges, there exists an array of promising solutions and resources that can help overcome barriers to adaptation finance and foster resilience in EU regions. The list, which has been growing over the past few years following tangible research efforts in the EU and elsewhere, includes several online platforms for technical assistance, knowledge repositories, innovation accelerators, marketplaces and fintech solutions. Apart from documenting available enablers and facilitators and underscoring their main attributes, this report attempts to link them to the adaptation finance barriers. Regions can benefit from the services provided by facilitators and platforms by accessing the tools most pertinent to their needs. While this is ongoing research, it enables regions to filter the available solutions after they

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have assessed the salience of the adaptation finance barriers with respect to their case. Project Preparation Facilities enable regions to address economic and market barriers, whereas the various accelerators cater to the regional needs regarding technological barriers. Finally, platforms offering technical assistance exhibit moderate to high relevance to all types of barriers, especially contributing to raising knowledge and awareness. This can prove to be a very fruitful exercise for the first step of the Adaptation Investment Cycle, as regional authorities and stakeholders can cross reference financial solutions to their most pronounced barriers – identified with the help of the P2R database and their self-assessment exercise.

Identifying the barriers to adaptation finance and acknowledging their salience based on the latest data is a crucial part of designing the Regional Resilience Journey (RRJ). Financing for adaptation is a building block of the RRJ manifesting throughout the process. The output of this report, combined with the self-assessment of regions and the expression of their perceived challenges through the EoI process are material to establishing a baseline for co-designing regional adaptation strategies. Moreover, this report aims to connect with the catalogue of adaptation finance mechanisms and sources developed as part D5.2 to identify and foster tailor-made solutions according to regional and project attributes. The output outlined in this report will contribute to P2R outreach activities and capacity building by being an integral part of the online Toolbox and the Finance Adaptation Lab, as well as part of the direct consultation with selected regions as part of the co-design of regional adaptation plans.

In conclusion, while the challenges of adaptation finance in EU regions are formidable, they are by no means insurmountable. By embracing innovation, collaboration, and bold action, the EU can overcome barriers, unlock opportunities, and build a more resilient future for its citizens. P2R aspires to assist regions in their quest for successful adaptation plans with the promotion of the RRJ. Moreover, the Adaptation Investment Cycle helps them co-design bankable adaptation projects, irrespective of the stage they are in. For regions to effectively prepare the ground for an efficient adaptation plan they need to have a nuanced view of the key barriers for attracting and using financial resources, as well as a clear understanding of the landscape of services and tools available for the preparation or implementation of their projects. This report provides a roadmap for regions in both of these crucial aspects and, in alignment with all P2R reports, tools and actions, strengthens their position in the challenging effort towards green transformation.

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Appendix

Appendix I - Additional Information and Material

Table A1:Mapping Climate Adaptation Barriers to Financial Solutions

	Technical Assistance	Project Preparation Facilities	Accelerators	Fintech Solutions
Economic and Market barriers	2	3	1	2
Socio-cultural and Behavioral barriers	2	1	2	2
Knowledge and Awareness barriers	3	1	2	2
Technological barriers	2	2	3	3
Political, Institutional and Governance barriers	3	2	1	1

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