IMPETUS

Turning climate commitments into action

Deliverable Report

Market perspectives report (v2):

Scenarios of the future and assessment of anticipated business

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Authors	Laura Armayones
Contributors	Conrad Landis, Phoebe Koundouri, George Feretzakis, George Halkos
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[1] PU = Public
CO = Confidential, only for members of the consortium (including the Commission Services)
R = Report
ORDP = Open Research Data Pilot

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Disclaimer

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Abbreviations

Abbreviation / Acronyms	Description
AUEB	Athens University of Economics and Business
BOOT	Build-Own-Operate-Transfer
CA	Climate Adaptation
CC	Climate Change
CEOs	Chief Executive Officers
CFS	Certificate of Financial Statement
CM	Climate Mitigation
CPI	Climate Policy Initiative
CSR	Corporate Social Responsibility
CSRD	Corporate Sustainability Reporting Directive
DACC	Departament d'Acció Climàtica, Alimentació i Agenda Rural (Department of Climate Action, Food and Rural Agenda)
DaaS	Data-as-a-Service
DFI	Development Finance Institution
DoA	Description of the Action
DS	Demo-site
EAB	External Advisory Board
EC	European Commission
EIB	European Investment Bank
EMaaS	Environmental Monitoring as a Service
ER	Exploitable Result
ESCACC	Estratègia Catalana d'Adaptació al Canvi Climàtic (Catalan Strategy for Adaptation to Climate Change)
ESG	Environmental Social Governance
ESRS	European Sustainability Reporting Standards
EU	European Union
EU ETS	EU Emissions Trading Scheme
GA	Grant Agreement
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IaaS	Infrastructure as a Service
ICMA	International Capital Market Association
IP	Intellectual Property
LE	Large Enterprises
LOB	Lobelia
MDB	Multilateral Development Bank
MITECO	*Ministerio de Transición Ecológica y el Reto Demográfico* (Ministry of Ecological Transition and the Demographic Challenge)
NBS	Nature-Based Solutions
NGO	Non-Governmental Organization
NTUA	National Technical University of Athens
OCCC	*Oficina Catalana del Canvi Climàtic* (Catalan Office for Climate Change)
PC	Project Consortium
PPP	Public-Private Partnership
QH	Quintuple Helix
RRF	Recovery and Resilience Facility
R&D	Research and Development

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SDG	Sustainable Development Goals
SFDR	Sustainable Finance Disclosure Regulation
SH	Stakeholder
SM	Sewer Mining
SMEs	Small and Medium Enterprises
TRL	Technological Readiness Level
UN	United Nations
VC	Venture Capital
WP	Work Package
WPL	Work Package Leader

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1 Executive Summary

This document, D6.6 Market Perspectives Report: Scenarios of the Future and Assessment of Anticipated Business Opportunities, has been developed as part of Task 6.2 between months M18 and M36 of the IMPETUS project. Its primary goal is to provide actionable guidelines for decision-makers in the industry and finance sectors, outlining the business opportunities that emerge from Climate Adaptation (CA) solutions developed under the IMPETUS project.

The report emphasizes the relevant role that the private sector plays in creating a supportive environment for climate adaptation. By aligning their strategies with CA initiatives, industry and finance actors (e.g., venture capital, insurance companies, incubators, etc.) can unlock significant economic, social and environmental potential while addressing pressing climate risks. To support this, the document presents a comprehensive framework detailing the relevant financing instruments, innovative business models, and key stakeholders involved in funding climate adaptation efforts.

The development of this framework was informed by two key sources: workshops held across 2 DS front-runners and extensive desk research. The workshops provided real-world insights from insiders of the regions and partners aware of the private and public dynamics while the desk research explored broader market and business trends and policy frameworks that influence CA solutions.

The report's conclusions offer clear, structured guidelines for decision-makers, designed to help them navigate the evolving landscape of climate adaptation. Beyond the final guidelines, that will be reviewed in D6.7, next steps are established for the following year of the project.

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1 Introduction and background

The growing importance of climate change, as well as the need for implementing measures of adaptation, has led to the elaboration of this report which constitutes guidelines for the industry and finance sectors in terms of the different business opportunities that come with implementing IMPETUS innovative climate adaptation solutions.

As further developed in this report, Climate Adaptation (CA)[1] refers to adjusting in our day-to-day lives about the observed impacts of climate change with the aim of adapting to the new situations. In order to implement such adaptation solutions, it is essential to find adequate financing on the one hand, as well as the private actors who can benefit from executing them on the other hand. Differently from the deliverable D6.4, this report puts its focus on the private sector when it comes to the financing and implementation of the IMPETUS solutions, whereas D6.4 was more directed at the public sector in terms of financing and policymaking.

The term Climate Finance denotes the different sources used for financing the actions addressed for Climate Mitigation (CM) and Adaptation and, while these flows have recently shown an increasing trend, a small proportion of them are aimed solely at adaptation. In addition, the private sector's role in climate adaptation finance is currently not being enough significant to cope with climate emergencies and a lot is still to do.

However, a relevant issue to ensure the crucial role of the private sectors is the economic sustainability of the solutions. CA is opening the possibility to innovative business models that can result in social, environmental and economic benefit. As further explained in the report, such models can have different aims such as avoiding losses due to climate change or increasing their revenue streams by offering new products and services related to adaptation. Different examples of business models that can be up taken for IMPETUS Climate Adaptation Solutions will be detailed in this deliverable.

Finally, the guidelines provided in this report hope to address these concerns so that the private actors can take advantage of climate adaptation business opportunities, and so that additional finance is mobilized for adaptation to climate change.

1.1 Objectives of task and deliverable

The primary objective of Task 6.2, led by EUT, is to support **decision-makers in industry and finance** by providing them with comprehensive briefings and guidelines on business opportunities arising from innovative climate adaptation solutions.

This task divided in 3 subtasks:

The first subtask (6.2.1) focuses on the **design of business models for innovative climate adaptation solutions**. Through a co-creation approach, this aims to illustrate how such solutions can be transformed into viable business models that benefit both entrepreneurs and investors. It will cover various aspects such as identifying forms of intellectual property rights, understanding the role of venture capital and financial investors, and exploring the contributions of existing industries active in the field. By facilitating exchanges within the quintuple innovation helix framework, this subtask will enhance resilience knowledge among IMPETUS partners.

[1] Introduction | UNFCCC

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The second subtask (6.2.2), led by AUEB, involves mapping major **EU initiatives relevant to innovative adaptation solutions**. This includes identifying green investment opportunities by reviewing EU investment plans like the Next Generation EU initiative for post-pandemic economic recovery, outlining sustainable financing initiatives, and examining the EU taxonomy. Additionally, the subtask will gather insights from the experiences of various involved policymakers.

The third subtask (6.2.3) aims **to formulate briefings and guidelines for decision-makers in industry and finance**. This subtask will make use of the information prepared in subtasks 6.2.1 and 6.2.2. It will include the market analysis for specific innovative solutions and recommendations related to the creation of synergies with public policy to maximize the impact of the proposed solutions.

This deliverable D6.6 is named 'Market perspectives report. Scenarios of the future and assessment of anticipated business opportunities' has the objective to expose the results of the work carried out until M36 under T6.2 and the next steps.

This document D6.6 is composed of the following parts:

- Methodological Approach: Starting from the tasks proposed for WP6 at a general level, the ones that will be contained in this deliverable will be specified here. Additionally, the methodology used to carry out such tasks will also be explained.
- Theoretical Framework: A general conceptual framework will be developed regarding climate adaptation finance, relevant for D6.6. The topics mentioned will be related to the business models and key stakeholders available for climate adaptation.
- EU initiatives mapping for financing climate adaptation solutions: In this section, the set of efforts from the EU to finance climate adaptation will be identified and explained.
- Business Opportunities on DS and Climate Adaptation Solutions Level: The results of the workshops that took place in DS2 and DS3 will be analyzed, in accordance with the goal of identifying the business opportunities arising from the different IMPETUS solutions.
- Conclusions: Using all the gathered information, as assessment of the potential business opportunities addressing climate adaptation will be developed. Lastly, the following actions to follow will be specified.

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2 Methodological approach

As already stated in D6.4 and represented in figure 2, WP6 is divided into 2 different levels of analysis. At the EU and Regional levels, an analysis of the climate adaptation solutions proposed in each DS.

In this specific deliverable and task, which is addressed at the decision-makers in the industry and finance sectors, a first theoretical framework will be carried out with the objective of having a general understanding of the most important financial terms for this case, which is essential to further make accurate analysis. Thus, in line with the first level of analysis previously mentioned, D6.6 will include a mapping exercise on the current available climate adaptation finance and market instruments in the EU.

Additionally, the workshops organized at DS2 and DS3 have enabled identification of the relevant financing barriers and opportunities in each region. Further workshops are to be carried out in the future for the other DS, with the same methodology (to be included in D6.9). The structuring of these workshops consisted of a first general characterization of the financial barriers and opportunities in the DS and then, the identification of barriers, opportunities, business models and stakeholders more specific to each solution. This last section of the workshops will be detailed and dissected in this report, while the first part will be included in the deliverable D6.4. This is due to the connection of the topics discussed in each section of the workshops with the corresponding reports in which they are included.

In the second level of analysis, D6.6 identifies the set of financing barriers and opportunities specific to each climate adaptation solution and includes an analysis of potential business models that can be used to implement such solutions, as well as an analysis on how to introduce them into the market. This has also been carried out based on the results obtained from the workshops, as previously explained, as well as from further research.

Finally, after analyzing the potential business opportunities for climate adaptation solutions in the different regions, a set of conclusions will be detailed at the end of this report. These conclusions will include the final guidelines for the finance and industry decision-makers for them to implement such business opportunities and, additionally, the further steps to be taken in the future.

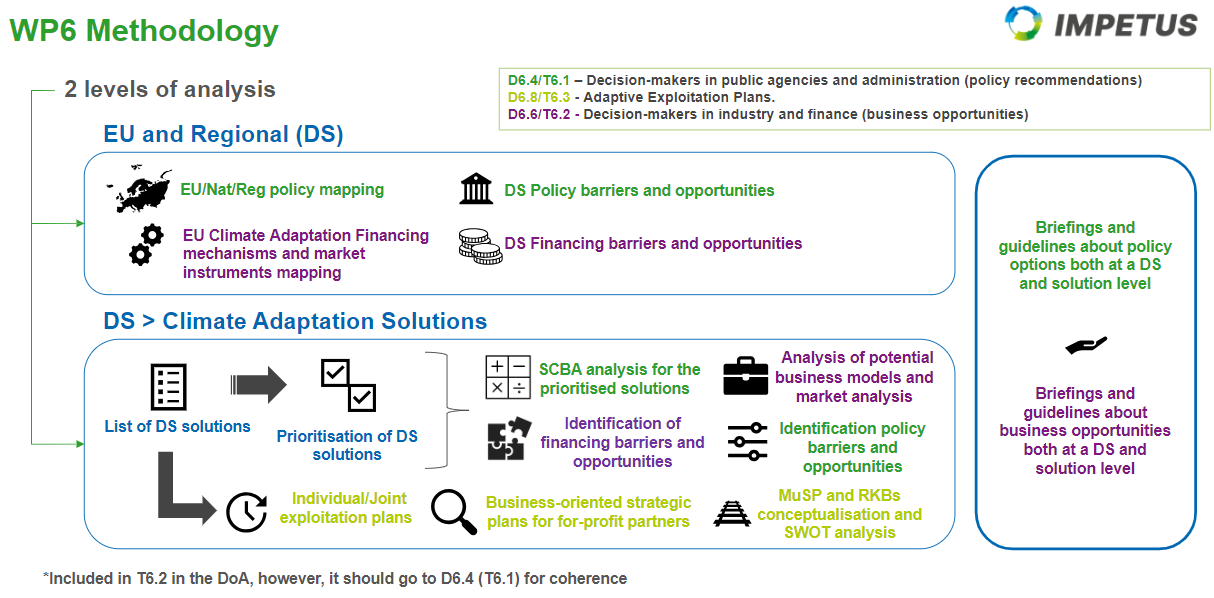

Figure 1: WP6 Methodology

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3 Theoretical framework

3.1 Climate Adaptation finance: financing instruments and sources

As stated by the UNFCCC[2], climate finance refers to local, national or transnational sources used to finance the adaptation and mitigation actions which are aimed at addressing climate change issues. Two separate branches arise from climate finance: mitigation and adaptation. The first one concerns relieving the already observed impacts of climate change to make them less severe, whereas adaptation means to anticipate future effects of climate change and apply measures to prevent or minimise them.

According to the Climate Policy Initiative [3], in general terms, climate finance flows have experienced an increase over the past years, reaching an annual average of 1.27 trillion USD in 2021-2022. However, this significant increase has been primarily explained by mitigation finance, while adaptation finance has lagged behind. This, in turn, has led to a faster growth rate for mitigation finance than for adaptation and, in 2021-2022, only 5% of total climate finance was dedicated to adaptation finance, leading to an increasing gap between the current adaptation funding and the countries' needs. The following figure illustrates the climate finance landscape in the period 2021-2022, in terms of the main sources and instruments used as well as the issue and sectors they were addressed at, which could either be adaptation, mitigation or a combination of both. This image was included in the Climate Policy Initiative report on the Global Landscape of Climate Finance for 2023.

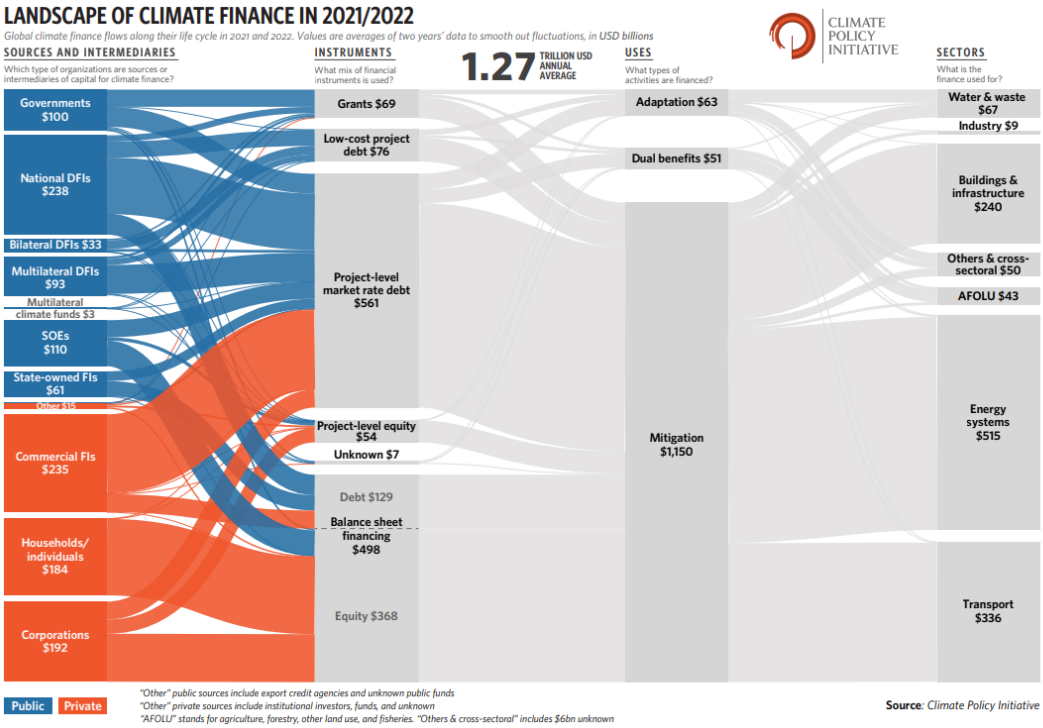

Figure 2. Climate finance landscape for 2021-2022

[2] Introduction to Climate Finance | UNFCCC
[3] https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2023/

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When detecting trends in CA finance[4], it is observed that finance flows are concentrated in specific regions, which include East Asia and Pacific, Sub-Saharan Africa, Latin America and the Caribbean. In the East Asia and Pacific region, roughly 85% of adaptation finance was raised and spent domestically. It is also important to note that developed economies are the ones mobilizing the most climate finance.

Another trend worth mentioning is regarding global climate negotiations. These negotiations, which take place annually under frameworks such as the United Nations Framework Convention on Climate Change (UNFCCC) through the Conference of the Parties (COP), focus on analyzing and deciding measures to address climate change. In order to increase financing for climate adaptation, especially from public financial institutions, the Climate Policy Initiative highlights that more climate negotiations are needed. Both public and private financial institutions have set goals and commitments for mitigation, but adaptation commitments are currently lacking. These limitations concern the definition, comparability, and ambition of such commitments.

An important conference related to climate change that should be noted is the COP 28[5], which took place at the end of 2023. Concerning the subject of global climate finance, the urgency of increasing adaptation finance flows was highlighted, with the aim of reducing the current adaptation financing gap. Other significant topics mentioned were related to the necessity of increasing sources of concessional finance for climate action and, more specifically, for climate adaptation which often requires non-debt financing. For the upcoming COP 29[6], set for November 2024, some topics that are to be discussed include objectives to provide climate finance to developing countries, and new goals for adaptation measures.

When it comes to the financing aspects, climate adaptation is financed via different actors both in the public and private sectors. Within the public sector, some of the important actors include Development Finance Institutions (DFIs) and multilateral climate funds for a more international approach, as well as Ministries of Finance, national Development Banks, national climate funds and state-owned enterprises at a domestic level. Other important actors within the European Union include its different institutions, such as the European Commission and the European Investment Bank. On the other hand, private actors consist of corporations, SMEs, commercial banks, institutional investors, insurance companies and private equity and venture capital. The Climate Policy Initiative mentions that mitigation funding is mainly originated by the private sector, whereas most of the adaptation funding comes from the public sector. There is also a voluntary sector composed of foundations and charities.

An important distinction needs to be underlined regarding the concepts of financing and funding. **Financing** refers to the money provided by a lender which must be repaid at a certain maturity and typically includes the payment of interest. On the other hand, **funding** refers to the money provided with no expectation of it being repaid in the future. However, although funding does not require the repayment of the money, it may come with other specific conditions. Some examples of sources of financing are loans or bonds and, as for examples of sources of funding, there are grants or subsidies.

Several barriers arise in climate finance which hinder the objectives of improving climate adaptation and the sources to finance it. One of these barriers is the availability of data to track adaptation finance flows. According to the Climate Policy Initiative[7], collecting data from the public sector is relatively easier than from the private sector, which in turn leads to less financing from such private actors. This fact accounts for the current low percentage of tracked adaptation finance that comes from private sectors, as opposed to the high proportion coming from the public sector.

[4] State and Trends in Climate Adaptation Finance 2023 (gca.org)
[5] COP28 Declaration on a Global Climate Finance Framework
[6] Finance, climate action plans and carbon markets: What to expect from COP29 (cam.ac.uk)
[7] https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2023/

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As for the financial instruments used for adaptation finance, there are several classes including debt, equity, grants or balance sheet financing. According to the Climate Policy Initiative, at a global level, the most employed instrument is debt, reaching 80% of total adaptation finance in 2021-2022, and then followed by grants and equity at a lower proportion. Considering the current debt obligations of countries and their high climate risk, it is necessary to diversify the financial instruments used for climate adaptation and to find more innovative approaches, such as green bonds, multilateral global funds and disaster risk financing. Other forms of financing that can be used include public-private partnerships and insurance.

The Pathways2Resilience platform[8] offers an overview of the different financial instruments commonly used for climate adaptation and classifies the different sources that provide them accordingly to their type: public, private or third. The following figure illustrates this representation:

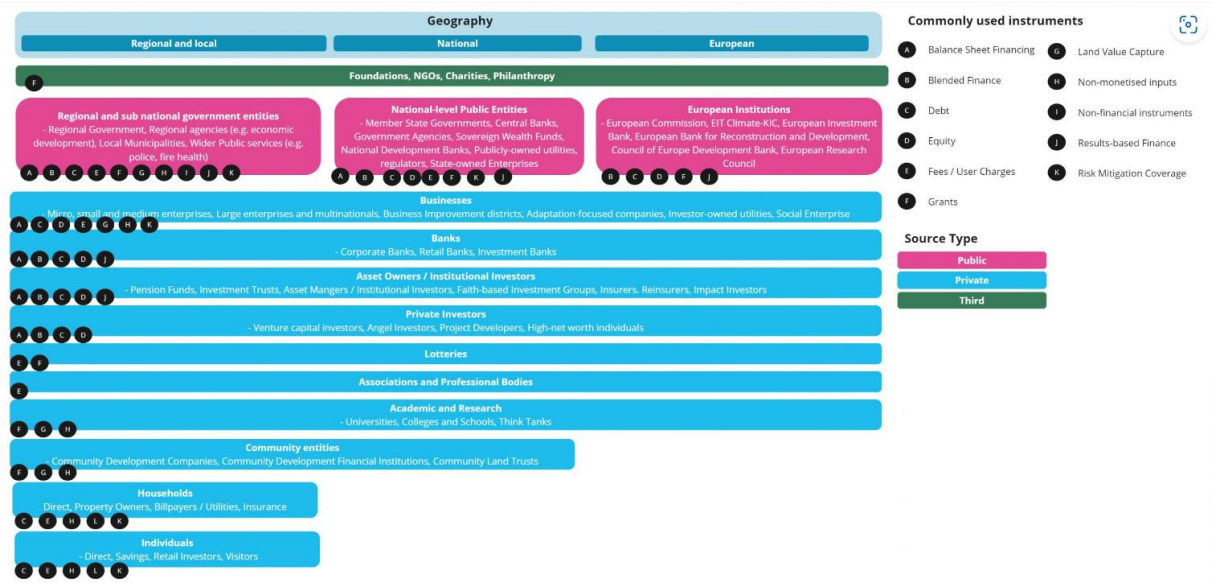

Figure 3. Financial sources and instruments for climate adaptation

Financial barriers also impede the implementation of climate adaptation measures, such as the high initial capital requirements that typically come with such projects. Additionally, there is a limited availability of financial instruments that have been specifically designed with the aim to support climate adaptation projects such as, for example, green bonds, impact investing funds and blended finance. As for access to capital markets, it becomes more difficult for smaller companies due to their size and perceived risk profile. Also, climate projects tend to be of high risk given their technological uncertainties or other factors like regulatory changes or long payback periods.

There are also **technological barriers** that come with adaptation projects. As previously mentioned, such projects come with higher risk and uncertainty due to their experimental nature and potential for technical failure. Also, in order to develop new technologies, investment in research and development is needed, posing another barrier. Then, when integrating the new technologies in existing systems and infrastructure, additional costs are involved making it more complex and difficult.

As for **regulatory barriers**, the insufficiency or inconsistency of government policies and regulations regarding climate change generates uncertainty that hinders investments. Also, abrupt changes to the already existing regulations can disrupt projects or deter long-term investments. When implementing the projects, lengthy and complex approval processes may arise which can lead to delays in the

[8] Financing Regional Adaptation - Pathway2Resilience (pathways2resilience.eu)

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implementation and higher costs. There is also a lack of financial incentives that reduce the attractiveness of such projects, such as grants and subsidies.

Market barriers include the limited size of markets where the climate technologies and innovations will be implemented, often denoted as niche markets, which lead to limited demand and, therefore, less attractiveness for investors. In addition, already established technologies, with which the new climate projects will have to compete, tend to have more advantageous market positions and economies of scale. This hinders entrance to these markets due to the competitors' advantages. Another barrier related to the market is the investors' lack of knowledge or information regarding climate innovations and their benefits and opportunities.

Lastly, **institutional barriers** also must be considered for the implementation of climate adaptation projects. One of them is the lack of coordination between different actors in the financial markets, such as between different types of investors, institutions and stakeholders. This leads to a more fragmented market and, therefore, more barriers to investing. There is also a limited collaboration between the private and public sectors, which restricts the flow of capital. In addition to this, another barrier is the limited capacity of project developers to prepare attractive projects that meet investor requirements. And finally, there may exist certain resistance from institutions to adopt new practices and technologies which can slow down decision-making and hinder the implementation of climate projects.

3.2 Business models for Climate Adaptation

Climate Adaptation (CA) has not yet reached the same level of economic importance as mitigation, which has led to a widening gap between societal needs and the available financing for CA measures. According to the World Economic Forum[9], it is crucial to adapt to climate change and, to do so, business cannot be left out of this equation. Given the small proportion of total climate adaptation finance coming from the private sector, observed in previous sections, there exists an untapped opportunity for businesses and an array of new business models that can be exploited with the aim of improving climate change adaptation. Such opportunities have the potential of helping businesses in reducing economic losses that can come from climate change, in finding new streams of revenue growth and in protecting communities where they operate in.[10]

As stated by the World Economic Forum in their report on Accelerating Business Action on Climate Change Adaptation[11], several companies have started to increase their focus on adaptation more recently. Two main factors help in explaining this trend: the impact of climate change observed on revenues and costs of businesses, and the increase in knowledge and disclosure regarding climate risks.

Consequently, the report includes the different actions that businesses can implement with the aim of avoiding losses, increasing revenues and savings and protecting communities and ecosystems in order to adapt and become more resilient to climate change.

[9] Capturing business opportunities arising from climate change | Arthur D. Little (adlittle.com)
[10] Accelerating business action on climate change adaptation | PwC
[11] WEF_Climate_Change_Adaptation_2023.pdf (weforum.org)

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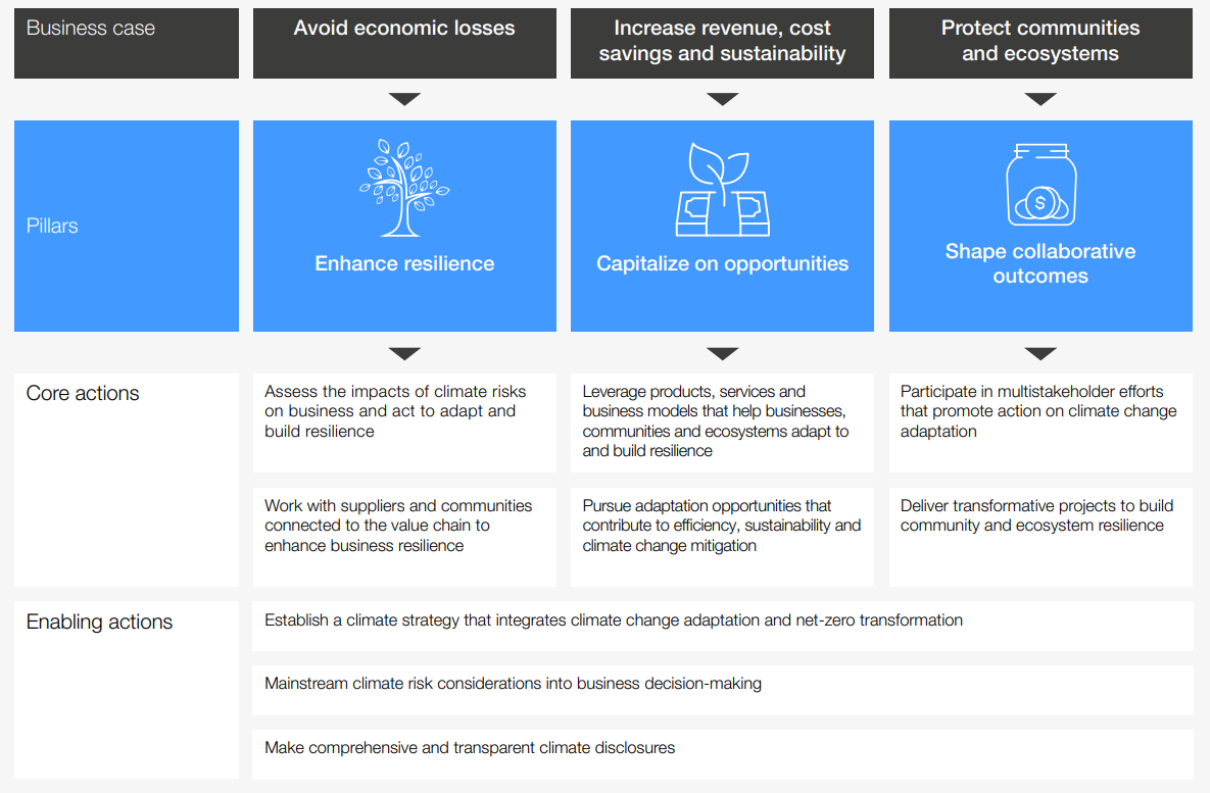

Figure 4. Framework by the World Economic Forum for business action on adaptation

The most relevant pillar for this section is the second one, consisting of capitalizing on opportunities for adaptation and resilience. As seen in the figure, businesses can profit from adopting models that contribute to climate adaptation and offer new products and services aimed at this matter.

A further report by the World Economic Forum[12] titled *Taking Stock of Business Efforts to Adapt to Climate Change* mentions that, although few companies are currently implementing measures to address climate adaptations, many have identified business opportunities to do so.

This same report identifies that a recent trend for companies when trying to include climate adaptation in their business is to implement **risk transfer measures** such **as insurance or derivatives, and risk reduction measures such as the adoption of new technologies**. This enables them to lower risks involved with climate change by diversifying their product portfolio and by achieving market diversification. Another trend observed in this report is that most companies choose to exploit the adaptation opportunities that will allow them to generate additional revenues, by developing new products and services related to climate adaptation.

It is crucial the **role of insurers** in creating **incentives** to carry out adaptation measures, drive innovation and close the protection gap. According to the publication[13] by the European Insurance and Occupational Pensions Authority (EIOPA), only a small portion of the economic losses from climate-related events in Europe are insured, leading to a significant insurance protection gap.

This same publication highlights the importance of the insurance sector, suggesting that it can help in increasing climate resilience by offering products aimed at preventing or minimizing climate risks. For example, insurance companies may typically offer lower premiums to policymakers who are increasingly implementing adaptation measures. However, unfortunately insurance companies are increasingly

[12] pwc-wef-taking-stock-of-business-efforts-to-adapt-to-climate-change-2023.pdf
[13] The role of insurers in tackling climate change: challenges and opportunities - European Union (europa.eu)

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covering only smaller climate risks due to the financial challenges of covering large-scale events. Thus, this highlights the limitations of insurance for severe climate impacts.

As stated in an article from the OECD[14], apart from offering financial protection for climate disasters, insurance also provides an analysis and identification of potential risks faced by households or businesses in specific areas and can provide measures to reduce and adapt to these risks. Additionally, as previously mentioned, it incentivizes adaptation through its premium pricing.

It is widely known that the risk of experiencing more frequent and intense catastrophic events related to climate change is expected to increase and, for this matter, the best possible solution to minimize such risk is by climate adaptation. Thus, according to this OECD article, the insurance sector should adopt the role of providing insurance coverage for climate risks and guarantee that this coverage is available and affordable for the parties in need.

On this note, some current issues in this industry that affect the availability of insurance, mentioned in an article by BCG[15], are the rise of the premiums charged for climate disasters, as well as the rise in the costs of covering such disasters faced by insurance companies. Ultimately, these factors can all lead to an increase of the insurance protection gap.

Thus, in the upcoming future, the insurance protection gap is expected to widen given the possible further intensification of climate change. An article published by the Financial Times[16] explains that new insurance products for climate risks and ways to measure such risks are needed in order to face the current issues in the industry. It therefore suggests that a new insurance framework is necessary, where both the public and private sectors intervene in implementing initiatives that help to insure disasters for households and businesses.

In terms of the private sector, the article suggests that the possible options are to either improve risk measuring so that there is lower uncertainty when providing the currently used insurances, or to offer innovative products that cover climate change catastrophes. Recent technological developments have enabled better risk assessment, and many insurance companies have the appropriate tools to identify and predict possible risks from different events. Alternatively, new insurance products include catastrophe bonds, which are a financial instrument purchased by investors to cover extreme weather events. The data used by insurance companies, however, often is employed to raise the premiums in vulnerable areas. As this practice improves risk accuracy, it can indeed make insurance less accessible to those most affected by climate risks, which raises concerns about equity and the affordability of coverage in high-risk regions.

All in all, the insurance industry is key in enhancing climate adaptation and, given its current struggles due to the intensification of climate change, further measures to strengthen such industry are necessary.

In IMPETUS, several distinct **business models** have been considered for the innovative solutions proposed in each DS with the objective of offering information for entrepreneurs and investors on how to exploit opportunities for climate adaptation. These innovative business models will serve to capitalize on opportunities for adaptation and resilience. These models are not just about offering new products and services but are also about structuring business operations in ways that align with climate adaptation goals.

One such model is the **product sales model**, where businesses directly sell products designed to enhance climate resilience, such as infrastructure materials that can withstand extreme weather

[14] Enhancing the insurance sector's contribution to climate adaptation | OECD
[15] A Climate Adaptive Insurance Risk Framework | BCG
[16] The uninsurable world: rethinking how to cover for climate damage (ft.com)

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conditions. Another important approach is the **service subscription model**, which offers services like real-time environmental monitoring or emergency management to local governments, environmental agencies, and other stakeholders, with revenue generated through subscription fees.

In the subject of infrastructure projects, the **Build-Own-Operate-Transfer (BOOT)** model is significant. This model involves a business designing, financing, building, and operating a project—such as a water treatment facility or renewable energy installation—before eventually transferring ownership to a government or community, thereby ensuring long-term sustainability.

Public-Private Partnerships (PPP) represent another crucial model, that involved the collaboration between private companies with public entities to deliver climate adaptation projects. These partnerships involve shared investment, risk, and reward, often resulting in the successful implementation of large-scale projects essential for community resilience.

Resource recovery models focus on the recovery and reuse of resources that might otherwise go to waste, contributing to both climate adaptation and sustainability. For instance, businesses can recover water, energy, or materials, which are then reintegrated into the production cycle, thus reducing dependency on scarce resources.

The **consulting and engineering services model** plays a vital role in climate adaptation. Companies offer specialized consulting services, including environmental impact assessments, risk analysis, and strategic planning, tailored to help clients develop and implement effective adaptation strategies.

Another increasingly important approach is the **data and analytics model**, where businesses provide data-driven insights and predictive analytics services to help organizations anticipate and respond to climate risks. This includes climate forecasting, risk assessment, and scenario planning, enabling better decision-making.

The **leasing model** allows clients to access climate adaptation technologies or equipment—such as solar panels or flood defense systems—without the high upfront costs associated with ownership. This model can be particularly appealing for businesses or municipalities looking to enhance resilience without significant capital investment.

For some services, the **pay-per-use model** is ideal, enabling customers to pay only for the amount of service or resource they consume. This is especially relevant for utilities like water or energy during climate-related events, allowing for more efficient resource management.

Hybrid models, which combine elements of these various approaches, can also be highly effective. For example, a company might integrate a product sales model with a service subscription model to offer comprehensive climate adaptation solutions that address both immediate and long-term needs.

In the context of *specific applications*, several distinct models have been proposed. **The service subscription model** is particularly relevant for **emergency management**, where real-time monitoring and prediction services are offered to local governments and agencies. The **open-source model** (often employing a freemium or advertising-supported approach) provides basic climate data for free, with premium features available for a fee. This model caters to a broad audience, from the general public to educational platforms and small businesses.

The **Environmental Monitoring as a Service (EMaaS**) model offers environmental monitoring and prediction services to industries such as agriculture, fisheries, and environmental consultancies. **Consulting and custom solutions** are also vital, providing specialized services like tailored reports, on-site assessments, and strategic planning to help clients interpret data and develop mitigation strategies.

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Revenue streams for these services typically come from project-based fees, retainer agreements, and consulting charges.

Another innovative approach is the **licensing model**, where climate adaptation technology is licensed to third parties, such as government agencies or large environmental monitoring companies. This model generates revenue through licensing fees, revenue sharing, or joint ventures.

In addition, the **public safety and community resilience model** emphasizes partnerships with local governments and community organizations to provide services like water quality prediction. These partnerships are often funded through grants, public funding, and donations, with revenue also coming from collaboration with local authorities and public awareness campaigns.

Corporate social responsibility (CSR) partnerships offer another avenue for businesses to engage in climate adaptation. In this model, businesses partner with corporations as part of their CSR initiatives, supporting community resilience and environmental sustainability. Revenue comes from co-branded initiatives, sponsorships of climate adaptation services, and corporate funding for research and development.

The **insurance model** is particularly crucial in enhancing climate adaptation. This model includes traditional insurance products but also innovative solutions like catastrophe bonds and parametric insurance, which offer payouts based on specific climate events. Insurance companies play a key role in creating incentives for adaptation, driving innovation, and closing the protection gap.

Additional models include the **Data-as-a-Service (DaaS) model**, which involves providing climate-related data and insights as a service, allowing businesses to access the information they need for informed decision-making. **Grants and public funding** are also important, often used to develop and implement climate adaptation projects in collaboration with governments or non-profits. **White-label solutions** allow companies to offer customizable climate adaptation technologies under different brandings, extending the reach of these innovations. Lastly, **educational and training services** focus on raising awareness and building capacity in climate adaptation, targeting businesses, schools, and communities.

Other of the business models offered consist of the **environmental credit trading model,** which sells environmental credits such as water or carbon offsets to those companies or organizations required to meet certain sustainability requirements and goals. As target audience, there are industrial facilities and corporations with sustainability projects, as well as the agriculture and forestry sectors and water-intensive industries.

The **Infrastructure as a Service (IaaS)** model, as the name suggests, offers specific infrastructure together with its design, construction and maintenance as a service, addressed mainly for industrial water authorities, agriculture operators, large industrial complexes and real estate developers as target audiences. The revenues are obtained from charging fees in exchange for the service provision.

Lastly, the **community-based cooperative model** consists of the formation of cooperatives in small communities with the aim of investing collectively in the solution in order to share costs and benefits. It is therefore mainly addressed to residential areas and small rural communities.

Business Model	Description
Product Sales Model	Direct sale of products that enhance climate resilience (e.g., infrastructure materials).
Service Subscription Model	Offers services like real-time environmental monitoring and emergency management for a subscription fee.

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Build-Own-Operate-Transfer (BOOT)	A business designs, finances, builds, and operates a project before transferring ownership to a government or community.
Public-Private Partnerships (PPP)	Collaboration between private companies and public entities to deliver climate adaptation projects.
Resource Recovery Model	Recovery and reuse of resources (e.g., water, energy) that contribute to sustainability and climate adaptation.
Consulting and Engineering Services	Consulting services including environmental impact assessments, risk analysis, and strategic planning for adaptation.
Data and Analytics Model	Provides data-driven insights and predictive analytics for climate risk forecasting and scenario planning.
Leasing Model	Allows clients to lease climate adaptation technologies (e.g., solar panels, flood defenses) instead of purchasing them.
Pay-per-Use Model	Customers pay for the exact amount of a service or resource they consume (e.g., utilities like water or energy).
Hybrid Models	Combines elements of different business models (e.g., product sales with service subscriptions).
Open-Source Model	Provides basic climate data for free with premium features available for a fee (freemium model).
Environmental Monitoring as a Service (EMaaS)	Offers environmental monitoring and prediction services to industries like agriculture and fisheries.
Licensing Model	Licenses climate adaptation technology to third parties, generating revenue through licensing fees.
Public Safety & Community Resilience	Partnerships with local governments to provide climate-related services like water quality prediction.
Corporate Social Responsibility (CSR) Partnerships	Businesses partner with corporations through CSR initiatives to support community resilience and sustainability.
Insurance Model	Includes traditional and innovative insurance products like catastrophe bonds for climate-related risks.
Data-as-a-Service (DaaS)	Provides climate-related data and insights as a service for informed decision-making.
Environmental Credit Trading Model	Sells environmental credits, such as water or carbon offsets, to organizations with sustainability goals.
Infrastructure as a Service (IaaS)	Offers infrastructure design, construction, and maintenance as a service.
Community-Based Cooperative Model	Small communities form cooperatives to collectively invest in climate adaptation solutions.

Table 1: Summary of business models for CA

3.3 Key players in financing climate adaptation

When it comes to financing climate adaptation projects, it is important to keep in mind the key stakeholders that can potentially be affected by climate change or be interested in exploiting new business opportunities in the field of climate adaptation. Taking this into consideration, this section is built upon the work developed by WP1 in the IMPETUS project (see D1.3).

In the Quintuple Helix (QH) model of innovation we find different typologies of agents: the academic system, the industry and economic system, the state, government and political system, and finally, the

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uniformed-citizens, media and culture. WP1 identifies and coordinates the engagement of these different agents.

Building upon WP1 framework, WP6 has identified the most relevant agents for the present deliverable D6.6, as crucial stakeholders to ensure the long-term sustainability and the scale-up of IMPETUS Climate Adaptation Solutions. In the table below, in bold, the key players are identified:

QH Sectors	**Natural Environment**			
	Academic System	Industry and Economic System	State, government and political System	Uninformed Citizens, Media and Culture (Media-based and culture based public)
Stakeholder Group	Public Research Institutes (University, Government research agency, etc.)	Financial Sector (Banks, Insurance, Investors) - **Venture Capital, Business Angels, Incubators**	Local governments	NGOs & Foundations
		Small and Medium Entreprises (SMEs)	Local authorities / agencies	
		Industry (Health, Water, Energy, Tourism, Agriculture, **Infrastructure**, etc.)	State / Province / Region Government and Agencies	
		Utilities (Water, Energy, Waste)	National/Federal Government and Agencies	
		Associations (SME, Health, Water, Energy, Agriculture, Tourism, **Infrastructure**)	Inter-ministry committees	
		Entrepreneur (business owner)	Topic specific task-forces/round-tables/committees	
			EU agencies	

Table 2: Relevant Stakeholders for WP6 (Quintuple Helix Model)

To start with, some of the main stakeholders relevant for financing climate adaptation consist of Research Institutes (Academia). These can be helpful in conducting research and providing insights into innovative solutions and recommendations for climate adaptation. Examples of these institutes include universities or government research agencies specific to the different demo-sites.

In the second place, regarding the industry and the economic system and especially in the financial sector, essential stakeholders are **venturing capital, business angels or incubators**. According to the World Resources Institute[17], investing in climate adaptation by these agents can be beneficial for investors as it generates a net return in several sectors, which include making new infrastructures more

[17] Adaptation Finance and Investment | World Resources Institute (wri.org)

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resilient, strengthening early warning systems or making water management more resilient, among others.

Investors, in general terms, can be categorized into different types, some of which have been briefly mentioned previously. One of these is **venture capital**(VC), and, as for the role they play in climate adaptation, it has recently shown an increasing trend. While venture capitalists were already investing in projects related to climate change mitigation, they have also started to provide capital for adaptation-related new business models. This is partly due to the general shift in focus to climate adaptation, considering that a relatively low level of total climate finance was addressed to this branch and most of it went to mitigation. Therefore, venture capitalists are increasingly investing in **Climate Adaptation Tech**, which is a concept that includes innovations aiming at facilitating adaptation to the current climate situations caused by climate change. For example, these innovations are related to the creation of sustainable infrastructures, disaster preparedness or water management.

According to a Forbes article[18], **venture capitalists** have started to focus more **on investing in climate tech startups** to address the issue regarding climate change. In 2023, investment in climate tech showed a decreasing trend within venture capitalists but, however, this situation has started to reverse more recently. Some causes of this reversal, discussed in the article, are regulatory support for investment, increased consumer awareness on climate change issues and the drive of firms to reduce energy costs by implementing more sustainable solutions. Some challenges found by the research elaborated by Endeavor Insight and HSBC[19], are the persisting problems that climate tech founders in accessing growth-stage capital and finding technical talent. Finding good mentors in climate tech is also a challenge, according to the report, as experience in both technology and climate has not been so usual in the latter decades. To ensure that the biggest impact is created, building international connections in ecosystems such as hubs or networks is crucial to be able to scale the opportunities in emerging markets.

The concept of **venture capital** refers to a source of funding for small businesses and startups with an important growth potential that have more difficulties in accessing capital markets. The investors also participate in the management of the firm and share their expertise in order to stimulate its further growth. Venture capital firms, which specialize in identifying new companies and providing funding to these, are a key stakeholder for climate-related startups. Even though VC prioritizing climate change mitigation is more frequent (e.g., Wavemaker impact, Lower Carbon capital, etc.), a slower trend is expanding their funding to climate adaptation and later-stage investments [20](Energy Ventures).

The changes in the regulatory landscape for funding since the Covid-19 has pushed significant changes in climate finance (**banks, insurance companies**, etc.). ESG (Environmental Social Governance) matters has created a new paradigm for the private sector and the last EC regulations and directives, such as the Sustainable Finance Disclosure Regulation (SFDR) and the Corporate Sustainability Reporting Directive (CSDR) has increased the professionalization and dedication of resources to comply to climate-related policies. Moreover, the EU Taxonomy harmonizes sustainable investments[21] that can support adaptation measures, such as the ones developed in IMPETUS.

[18] Betting Big On Climate Tech: How VCs Are Powering Climate Solutions (forbes.com)
[19] https://lp.endeavor.org/climatetech2022
[20] https://www.technologyreview.com/2022/10/19/1061958/bill-gates-energy-venture-fund-is-expanding-into-climate-adaptation-and-later-stage-investments/
[21] https://climate-adapt.eea.europa.eu/en/eu-adaptation-policy/sector-policies/financial

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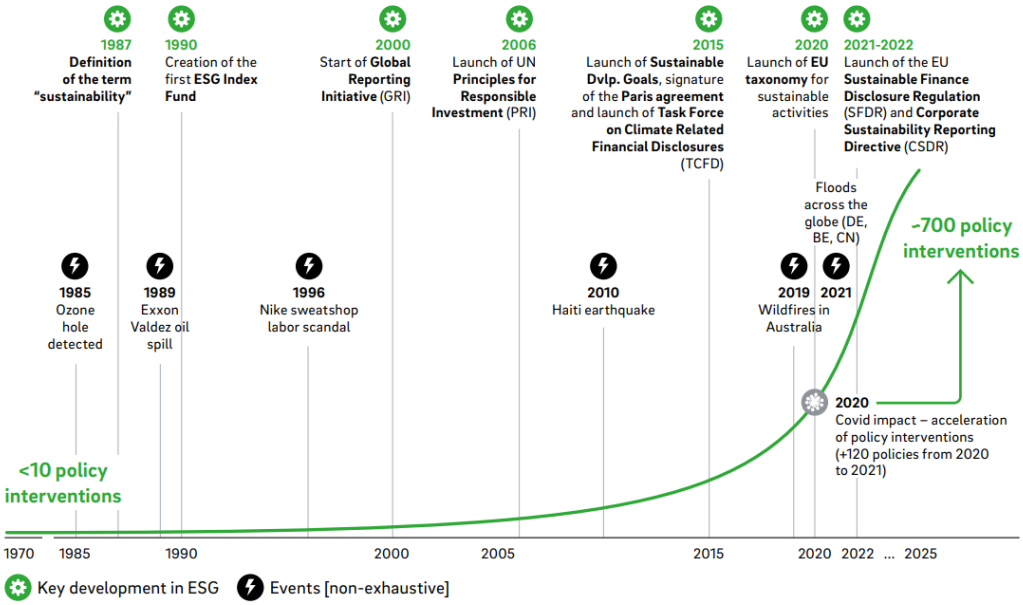

Figure 5: Regulatory landscape for funding. Source: UNPRI, Roland Berger

In the financial and investing market**, business angels** are also a key stakeholder. Business angels consist of people who invest in new startups in exchange for a participation in the capital of the firm, to obtain profit from their investment. They are useful for such companies that, given their recent creation, do not dispose of enough capital for their investments and, thus, they are crucial stakeholders to be considered for startups working on climate adaptation. There exists business angels' platforms, syndicates and networks working in climate-related aspects. For instance, Climate Angels and Green Angels Syndicates.

On the other hand, **incubators**, which have the main purpose of helping new businesses and startups grow in exchange for a return on their investment, typically in the form of equity stakes, has also dedicated more resources to climate mitigation and adaptation. The services provided by these incubators can include access to investors, office space or education and mentorship, among others. Some examples of incubators dedicated to climate tech are Techstarts, Creative Destruction Lab, Net Zero X and Third Derivatives.

The key challenges that these stakeholders face when investing in climate adaptation are collected in the table below. These challenges need to be considered by the IMPETUS partners when looking for investment and resources. To validate this information, in the following deliverable D6.7, interviews will be held with these agents.

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Challenges of the financial sector for funding climate adaptation (Banks, insurance companies, VC, business angels, incubators)
Information asymmetries and knowledge gap
Size of adaptation projects and investment horizon
Perception of low returns
Uncertain financial value of adaptation measures [22]
Difficulties to find technical talent
Perception of higher risk exposure
Lack of regulatory framework to incentivize investment[23]
Market inefficiencies leading to inaccurate pricing and inadequate concerns for climate hazards and risks[24]

Table 3: Challenges of the financial sector for funding climate adaptation (Banks, insurance companies, VC, business angels, incubators)

Therefore, in a more general view, the key stakeholders considered in the IMPETUS project for financing climate adaptation involve entrepreneurs and CEOs of businesses from a private perspective, as well as strategic knowledge holders such as managers and technical knowledge holders such as technical experts. From a public perspective, politicians and mayors ought to also be considered. Interviews with external experts are foreseen to be included in the last T6.2 deliverable D6.7.

Other stakeholders considered in the IMPETUS project are **Small and Medium Enterprises (SMEs)[25],** as their innovative capabilities and their ability to implement changes more effectively enables them to adopt climate adaptation measures more easily as opposed to larger corporations. Many of them have in their core the contribution to the climate adaptation of sectors such as agriculture, energy, water, infrastructure and health. For traditional SMEs not providing climate adaptation solutions, the consideration of climate hazards is urgently needed, as they are also the ones more vulnerable[26] to climate change.

To defend its interests, SME associations and clusters are crucial to incentivize and support SMEs to develop and pursue business models related with climate adaptation. In the field of climate adaptation, SMEs can take advantage of their local knowledge on consumer demand and supply in order to better respond to the specific climate change impacts observed in the regions where they operate and, this way, they can contribute to increasing climate resilience in local communities. In countries where the DemoSite (DS) are located, such as Spain, SMEs contribute to 61,5% of the total GDP[27]. That is why, the involvement and proactiveness of SMEs and their networks, associations or clusters is crucial to enable, for instance, the decarbonization of their activities, and their adaptation to the climate hazards that may be affecting their continuity.

In the case of **start-ups**, newly created companies with a high technological component and fast growth, attracting investors to provide capital is essential. The emergence of climate-related startups has captured the interest of investors and many of them propose innovation business models for CA. Some

[22] https://climatechampions.unfccc.int/what-it-takes-to-attract-private-investment-to-climate-adaptation/
[23] Regulatory and Policy Barriers - CPI (climatepolicyinitiative.org)
[24] https://www.adaptation-undp.org/sites/default/files/2024-07/Mobilizing%20investment%20for%20adaptation%20and%20resilience.pdf
[25] Small businesses, big impact: SMEs driving the Race to Zero - Climate Champions (unfccc.int) , Micro, Small, and Medium Enterprises: Key Players in Climate Adaptation | World Resources Institute (wri.org), What is the role of SMEs in climate resilience and adaptation? (instituteofsustainabilitystudies.com)
[26] https://www.csis.org/analysis/small-and-medium-sized-enterprises-blended-finance-and-climate-change-sub-saharan-africa
[27] https://www.climatestrategy.com/es/informe_28.php

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examples of start-ups designed to face climate hazards and propose adaptation measures are SolCold[28], GreenCity Solutions[29] and Ecogrid[30].

It is also important to consider **governments** from different states, provinces or regions where the IMPETUS demo-sites are located as key players, and also local governments and authorities. These can have an essential role in enabling and facilitating the implementation of climate adaptation projects through financing and regulations. Additionally, there are different state, province or region authorities and agencies specific to each demo-site that need to be considered for financing climate adaptation.

At a higher level, **national or federal governments, authorities and agencies** can also play a significant role as stakeholders, as well as **EU agencies**. As for national governments and authorities, they can help by implementing policies, plans and budgets that facilitate the financing for climate change adaptation. They also contribute by allocating funds and coordinating adaptation efforts from different sources, as well as by potentially cooperating with other key stakeholders. On the other hand, among the instruments used by the EU to finance climate adaptation, the main ones consist of the Recovery and Resilience Facility, the LIFE programme, inside which there is the subprogramme for Climate Change Mitigation and Adaptation, and the Horizon Europe funding programme. All these mentioned programmes aim at providing financial resources for projects related to environment and climate action and for research and innovation. [31]
Lastly, **NGOs and foundations** dedicated to addressing climate change issues also ought to be considered as key stakeholders. A relevant example is the Global Centre on Adaptation[32], an international organization focused on helping countries in addressing climate adaptation. It is also involved in providing finance for initiatives on adaptation, as well as providing guidance on how to finance such projects. Additionally, the Red Cross[33] has set up initiatives directed at climate adaptation and its financing, especially through the Climate Centre[34]. One of its ongoing efforts consists of the Locally Led Adaptation project[35], in which aid is provided to countries with the aim of promoting adaptation to climate change. UNICEF is also relevant, as some of its projects are aimed at supporting child-centred climate adaptation[36]. As a last example, the UN Environment Programme[37] is also relevant to be considered, as its main focus is on promoting climate adaptation and providing aid for this matter, also in terms of financial assistance.

[28] https://www.solcold.co/
[29] https://greencitysolutions.de/en/
[30] https://ecogridtech.com/
[31] EU funding of adaptation (europa.eu)
[32] Home - Global Center on Adaptation (gca.org)
[33] Home – Red Cross EU Office
[34] Red Cross Red Crescent Climate Centre – The Climate Centre supports the Red Cross and Red Crescent Movement and its partners in reducing the impacts of climate change and extreme weather events on vulnerable people.
[35] Locally led adaptation – Red Cross Red Crescent Climate Centre
[36] Climate change and environment | UNICEF
[37] UNEP - UN Environment Programme

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4 EU initiatives mapping for financing climate adaptation solutions

4.1 Overview of EU's Commitment to Climate Adaptation

The EU leads with international climate policy. It recognizes that while mitigation of climate change-that is, reduction in the emission of greenhouse gases-is highly essential, there is a need to adapt to climate change. Adaptation includes modification of socio-economic structures, infrastructure, and ecosystems to partly reduce adverse impacts associated with the inevitable effects of climate change, such as temperature increase, increased frequency of extreme weather events, and sea level rise. Adaptation has been integrated into the comprehensive climate strategy of the EU to make its member states resilient in the increasingly volatile climate.

4.1.1 Strategic Vision for Climate Resilience

The adaptation activities of the European Union focus on the European Green Deal, making Europe the first climate-neutral continent by 2050. This policy in the future will not only address mitigation issues but also adaptation to the changed climate. The Commission added that adaptation would be mainstreamed in all policy areas, such as agriculture, fisheries, transport, and energy, in pursuit of the recently launched European Green Deal. This also goes a long way because adaptation to climate-related risks is dealt with in most sectors of the economy and society. In 2021, the EU adopted its Climate Adaptation Strategy to support Green Deal objectives. The strategy, in comparison with problem awareness regarding climate change, moves to supply concrete solutions and a roadmap of preparedness for the member states. It stresses the need to increase knowledge about climate risks, improve assessments and planning regarding climate risks, and to increase integration concerning climate adaptation among EU policies. The European Union's Fit for 55 packages, with the goal of a 55% reduction in greenhouse gases by the year 2030, is an act clearly in line with adaptation strategies. This is essentially a mitigation-directed package; hence, measures under Fit for 55, like an increase in renewable energy, energy efficiency, and reduction of the dependency on fossil fuels, will inherently support climate resilience. It enhances the resilience of infrastructure to climatic shocks, such as heat waves, drought, and disruption in supply chains, by promoting cleaner and more sustainable energy systems.

4.1.2 The Role of Financial Instruments in Scaling Adaptation

Climate change adaptation will need significant investment: the European Environment Agency projects that climate change damage in the EU would reach about €190 billion each year by 2080 if no further action is taken in terms of adaptation. To close the investment gap, the EU has elaborated a set of financial mechanisms and instruments capable of leveraging public and private capital (see subsection 4.3). These fiscal mechanisms lie at the heart of further reductions in investment risks linked to adaptation efforts and ensure a flow of finance that is necessary for the development of resilient infrastructure contributing to the support of the most vulnerable communities. Nature-based solutions fall in these adaptation strategies and have been highlighted by the European Union: ecosystems restoration, sustainable agriculture, maintenance of biodiversity—often much cheaper and more sustainable than hard infrastructures. By integrating nature-based solutions into the climate adaptation strategy, the EU not only responds to climatic risks but also protects biodiversity and maintains healthy ecosystems. In the meantime, the EU puts an accelerator on climate resilience. Linked financial commitments to research and development, particularly under programs such as Horizon Europe, are nowadays making great strides possible in early warning systems, climate modeling, and resilient materials. The advances are therefore important in the design of new instruments and technologies that will enhance response in climate-related effects.

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4.1.3 A Collaborative Effort Across Governance Levels

Successful adaptation requires close cooperation at the level of the national, regional, and local government. The European Union understands that although setting the policy framework and financial mechanisms is possible at the EU level, adaptation measures are concretely applied at the local level. At the forefront of climate-related hazards, local governments deal with problems of urban flooding, coastal erosion, and heatwaves within the constraints of very dense urban areas. Accordingly, the EU is committed to integrating collaboration among different layers of governance; ascertaining that local governments have adequate financial resources, technical support, and policy support necessary to ably enact adaptation programs. For example, it emphasized issues related to inclusivity and equity in its adaptation framework. This will envisage a Just Transition Mechanism for targeted support to regions and communities most vulnerable to the socioeconomic impacts of a transition to a greener economy. This means that in the context of adaptation, it calls for adequate resourcing whereby definitely the most climate-sensitive areas, coastal and rural zones, would have to adapt to the new emerging climatic conditions, ensuring there is not exclusion of a person.

4.1.4 Strengthening Resilience Through Public-Private Partnerships

Given the scale of the challenge, it leaves room for mitigation with public financing at the heart of climate adaptation. The EU has developed relevant frameworks and innovative financial vehicles, including green bonds and blended finance arrangements, to attract private investment in adaptation projects. Of particular welcome will be the role of public-private partnerships in the field of infrastructure, where businesses can bring invaluable expertise and financial resources to the table, supporting climate-resilient cities, energy systems, and transport networks. In the last few years, the EU has established itself as a global leader in green finance through, among other efforts, issuing the so-called EU Green Bond. They are instruments with clear targets in addressing the financing of activities specifically in the area of mitigation and adaptation. They therefore create clear and responsible investment opportunities for institutional investors in EU climate objectives. The innovation in these new green financial instruments will make the EU competitive in creating an active market for sustainable investments which will make possible a sufficient volume of adaptation activities under the green transition.
The EU adaptation commitment will have to increase in scope and scale with greater frequency and severity of climate impacts. Climate resilience should deal with the ability of economies, ecosystems, and communities to thrive under a changed climate and should not simply concentrate on the safeguarding of physical infrastructure. The adaptation approach of the European Union is all-inclusive, mainstreamed across all sectors in its climate policy, and uses financial resources. Its success will be gauged not just by how well Europe is resilient from near-future climate crises but by the opportunity it opens toward seizing the promise of more resilient, low-carbon, and inclusive societies.

4.2 Major EU Financial Initiatives Supporting Climate Adaptation

4.2.1 LIFE Programme

The **LIFE Programme**[38] has been one of the most important funding instruments for climate action under the European Union. The programme started in 1992 and focuses on funding the adaptation of climate and nature conservation projects. It offers financial support to demonstrate projects showing the feasibility of new approaches and techniques in the policy environment. The LIFE Programme finances demonstrations on climate finance. It enables public bodies, SMEs, NGOs, and regional authorities to develop tangible concrete strategies of adaptation. It has a general focus on the topic of Climate

[38] https://cinea.ec.europa.eu/programmes/life_en

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Adaptation, but projects are routinely focused on natural resource management, disaster risk reduction, and development of resilience for extreme weather events. Similarly, major activities under the LIFE program have been toward mitigating coastal erosion, improving water management, and developing early warning systems against natural calamities. These will not only go a long way in building climate resilience but also spur economic growth through the growth of environmental technology.

4.2.2 Horizon Europe

Horizon Europe[39] is the number one EU research and innovation investment program, endowed with an amount of € 95.5 billion for a period between 2021 and 2027 aimed at driving the green technologies of tomorrow, particularly in climate adaptation. The program boosts collaborative projects among research organizations, academic institutions, and the private sector for the development of methods of mitigation and adaptation related to climate change. Among the missions of Horizon Europe, "Adaptation to Climate Change" is oriented to increasing societal resilience due to climate-related hazards. It has catalyzed projects that come up with tools that anticipate and mitigate the effects of climate change, early warning systems, new construction materials, and climate-resilient infrastructure. Horizon Europe enables funding in research and innovation to take place on such projects, enabling Europe to be at the helm in green technological advance.

4.2.3 EU Innovation Fund

The Innovation Fund[40] is among the world's most capital funds for supporting low-carbon technologies. It finances small and large-scale projects in all sectors and across entities, said to be capable of significant emission reductions via grants and risk-sharing instruments. In that view, all adaptation and mitigation efforts whose focal interest has been the decarbonization of industrial processes, consequently, are linked with the goals of the Innovation Fund on climate. This fund supports private sector involvement in the just transition, sharing risks economically in projects involving innovation. It guarantees that leading businesses, technology companies, and innovators in climate programs supported by the fund are important driving forces in large-scale development, bringing about carbon capture and storage technologies, renewal energy production, and new materials with prospects for adaptation to climate change. The fund ensures an effective force toward the transition of the European Union into a climate-neutral economy by 2050.

4.2.4 Recovery and Resilience Facility (RRF)

The RRF[41] forms the centerpiece of the EU's recovery plan out of COVID-19; it is endowed with a funding sum of €723.8 billion to boost green and digital transitions. Indeed, the RRF constitutes both grant and loan mechanisms that provide financial support for investments in all European Union countries in projects that contribute to economic growth and the overall strategy for climate resilience. RRF funding fits well with the REPowerEU plan, which focuses on reducing dependence within the EU's perspective in relation to fossil fuels and going into higher gear on renewable energy. The focus will be climate changes related not only to mitigation and adaptation but also in building resilience in key infrastructure sectors: energy, water, transportation, etc. The project seeks to pursue partnerships and continuation between government bureaus, civil society, and the private sector in venturing into enormous climate adaptation practices that heighten urban resilience while dwindling vulnerabilities.

[39] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en
[40] https://climate.ec.europa.eu/eu-action/eu-funding-climate-action/innovation-fund_en
[41] https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en

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4.2.5 European Green Deal & Fit for 55

The European Green Deal[42] is an ambitious set of EU policies and programs that will make Europe the first climate-neutral continent by 2050. Part of the Green Deal, the Fit for 55[43], sets the intermediary target at a reduction of 55% in emissions by 2030, in comparison to the levels of 1990. These are mainly regulatory frameworks that underpin the path of the Union toward long-term sustainability and climate neutrality. Under the Green Deal, the European Union has started a package of legislative acts and financial tools to enable mitigation and adaptation strategies. They are about sectorial energy, agriculture, transport policies, and so on that add resilience at all levels toward climate change. Indeed, such a Green Deal would handle climate adaptation and mitigation, thereby galvanizing cooperation from financial institutions, corporations, and governmental entities toward the realization of these objectives. This is one important project in shaping the regulatory architecture for climate finance; it even fosters sustainability within investment throughout the European Union.

4.2.6 Connecting Europe Facility (CEF)

CEF[44] is a major resource for infrastructure development in all of Europe. The key focus areas by CEF include transport, energy, and digital services to ensure full integration within robust and resilient climate change investment portfolios. CEF financing supports projects in the vital infrastructure through different alternative means that are both resilient and sustainable, such as transnational energy grids and transportation systems. The EU, through the CEF program, supports wider climate objectives with direct investments in cross-border renewables projects, both in adaptation and mitigation, thus supporting efforts of integrating renewable sources into transport systems resilient to climate change. The program contributes to energy security in EU member states and furthers the use of renewables.

4.2.7 REPowerEU[45]

The REPowerEU plan supports the European Union roadmap to breaking dependency on fossil fuels, in other words, meaning that it is building energy security in response to Russia's invasion of Ukraine. It targeted investments totaling €210 billion until 2027 and fast-tracked the integration of renewables into sources of energy, built up energy efficiency, and enabled progress in cross-border energy infrastructure. To sum it up, REPowerEU has both strands in its functions: focus on climate adaptation and mitigation through supporting diversification of energy sources to cater to European energy systems' resilience. This investment in renewable energy projects, along with innovative energy storage and infrastructure that are resilient against weather extremes, will afford greater security and resilience.

4.2.8 Just Transition Mechanism (JTM)

It would ensure the financial and technical support of the Just Transition Mechanism[46] toward the regions and workers that would be the most affected in such a transition toward a low-carbon economy. The JTM interventions, in particular, are designed to avoid such impacts in working specifically with regions that have been highly reliant on fossil fuels or carbon-intensive industries. The Just Transition Mechanism includes a Just Transition Fund, to which it has provided €150 billion. It is to cater to regions that need diversification in their economies and have to focus on social inclusion while phasing out environmentally damaging practices. This mechanism, therefore, reconciles climate mitigation policies with social adaptation not to leave anybody behind in the transition to a sustainable economy.

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[42] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
[43] https://www.consilium.europa.eu/es/policies/green-deal/fit-for-55/
[44] https://cinea.ec.europa.eu/programmes/connecting-europe-facility_en
[45] https://www.consilium.europa.eu/en/policies/eu-recovery-plan/repowereu/
[46] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en

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4.2.9 European Investment Bank (EIB) Climate Action

The EIB[47] is the EU climate bank committed to devoting at least 50% of its financing to climate action and environmental sustainability by 2025. This touches every aspect, from large projects to carbon reduction, climate resilience, green innovation up to small projects. The EIB has a very critical role in financing mitigation and adaptation projects within the renewable energy, energy efficiency, sustainable transport, and urban resilience sectors. For this reason, its Climate Action Plan should mobilize €1 trillion in climate financing by 2030 and be an instrumental player in delivering the EU climate and energy goals.

4.2.10 European Structural and Investment Funds (ESIF)

The major five funds under the European Structural and Investment Funds that help clarify the way forward for economic development within the European Union have mainly pointed out regional disparities and sustainable development. For example, investment in infrastructure and innovative priorities on climate resilience in the case of ERDF and Cohesion Fund under ESIF. ESIF addresses both mitigation and adaptation by financing projects in vulnerable regions for climate risks, while at the same time stimulating green innovation and creating jobs.

4.2.11 Natural Capital Financing Facility (NCFF)

The NCFF[48] is an EIB initiative, in collaboration with the European Commission, to support biodiversity and fight climate change through better use of natural capital. The NCFF will underpin investments in projects for the development of nature-based adaptation strategies for climate change, such as wetland restoration, reforestation, and sustainable agriculture. The commitment of resources to ecosystem resilience-building initiatives demonstrates that this institution prioritizes climate adaptation to achieve long-term environmental sustainability and reduced vulnerability to climate-related impacts.

4.2.12 European Climate Pact

The European Climate Pact [49]is a grass-root movement, which engages citizens, businesses, and local authorities in activities to address climate change. Under this pact, individuals and organizations are encouraged to pledge actions toward cutting carbon emissions, advocate for lifestyles that are sustainable, and support the climate objectives of the European Union. Though the Climate Pact itself does not finance projects as an organization, it plays an important role in public engagement and creating a climate culture to improve mitigation and adaptation within the Union.

4.2.13 European Social Fund Plus (ESF+)

The European Social Fund Plus (ESF+) [50]sets out to be the main EU fund: More and better jobs, social inclusion, and upskilling through education. While the prime focus remains on matters of social and economic cohesion, other core social impacts of climate change are also catered to, the reskilling programs that would facilitate workers in transitioning into green jobs. The ESF+ will also support actions in the area of climate adaptation by equipping labor with the skills needed for the green transition, particularly in regions hardest hit by decarbonization.

[47] https://www.eib.org/attachments/thematic/eib_group_climate_bank_roadmap_en.pdf
[48] https://www.eib.org/attachments/documents/ncff_municipalities_en.pdf
[49] https://climate-pact.europa.eu/index_en
[50] https://european-social-fund-plus.ec.europa.eu/en

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4.2.14 InnovFin Energy Demonstration Projects (EDP)[51]

The **InnovFin Energy Demonstration Projects (EDP)** initiative supports innovative energy projects at a demonstration or pilot stage of development, close to commercialization. This debt or guarantee programme finances activities whereby companies develop and upscale new technologies in the renewable energy sector. Although the principal climate focus is on mitigation, InnovFin EDP also finances projects that enhance resilience against climate impacts through improvements in energy infrastructure, thereby contributing indirectly to climate adaptation.

4.2.15 EU Missions under Horizon Europe

With Horizon Europe, the European Union has launched five missions that target many big global challenges facing us today. Among the five, Adaptation to Climate Change aims to enhance the resilience of Europe to climate change by informing new approaches in agriculture, urban development, and the management of ecosystems. The mission in particular fosters climate adaptation policy through projects on the development of new technologies and the upscaling of resilience in the most vulnerable regions, plus the improvement of public awareness about the risks resulting from climate change.

4.2.16 Cohesion Fund

The Cohesion Fund[52] invests in projects that contribute to infrastructure development and environmental sustainability. It provides finance to EU member states with a GDP per capita below 90% of the average in the EU. It plays an important role in reducing regional disparities through its financing of environmentally friendly infrastructure, contributing to climate adaptation and adding to resilience. A few of these major projects are flood prevention schemes, coastal defense mechanism strategies, and water management frameworks that bring relief to the affected vulnerable populations.

4.2.17 Just Transition Fund (JTF)

The **Just Transition Fund (JTF)**[53] targeted regions whose economies are overly reliant on heavy industry. The JTF would help them tailor-make financial instruments with a view to assisting such regions in transitioning toward a greener economy, keeping social cohesion high, and not losing any jobs in the process. The thematic focus of JTF on climate extends to both mitigation and adaptation. A given share has been written into projects of economic diversification, workforce reskilling, and greening of industry.

4.2.18 European Urban Initiative (EUI)

The EUI[54] is in and of itself a new financial tool to create sustainable urban development in European Union cities. That means it will provide investment at a municipal level for innovative actions that increase climate resilience, energy efficiency, and social inclusion. EUI spans climate adaptation and mitigation—from heatwaves and flooding at the city scale down to incorporation of green space within the urban fabric.

4.2.19 Circular Cities and Regions Initiative (CCRI)

The CCRI[55] will be part of the Circular Economy Action Plan of the European Union, through which it will offer support to the development of circularity in urban and regional areas. It will accelerate this transition

[51] https://www.eib.org/attachments/thematic/innovfin_energy_demo_projects_en.pdf
[52] https://ec.europa.eu/regional_policy/funding/cohesion-fund_en
[53] https://ec.europa.eu/regional_policy/funding/just-transition-fund_en
[54] https://www.urban-initiative.eu/
[55] https://circular-cities-and-regions.ec.europa.eu/

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not only financially and technologically but also give support to city and regional areas transition into the circular economy by reducing waste, enhancing resource efficiency, and being resilient to climate change. Adaptation is the main thrust regarding climate issues, as CCRI fosters sustainable uses of resources against the caprices of climate change.

4.2.20 Climate-KIC

Climate-KIC[56] is the most prominent public-private climate innovation partnership in Europe, supporting entrepreneurs, researchers, and policymakers in developing novel solutions that realign economic sectors with our biosphere. Through the power of collaborative partnerships, Climate-KIC finances educates, and connects people to fast-track green innovations that foster a better world. The interest in climate change will go to adaptation and mitigation while having an interest in entrepreneurship development and fast-tracking the commercialization of climate solutions.

4.2.21 European Maritime, Fisheries and Aquaculture Fund (EMFAF)

The EMFAF[57] finances projects directed towards the attainment of sustainable fisheries and marine ecosystems. It involves financing only those projects that contribute particularly to strengthening the resilience of climate change in coastal communities and marine ecosystems. Currently, adaptation and mitigation measures having to do with protection against biodiversity in the marine seas, increased resilience of communities to heightened sea levels, and extreme events, including promoting sustainable aquaculture, are some of the things pertaining to climatic issues.

4.3 Financial Instruments and Strategic Initiatives

The European Union has designed a range of financial instruments and tools that ensure sufficient capital mobilization for climate change adaptation and mitigation projects. They are specifically done in such a way as to attract the interest of both the public and private sectors for the scaling up of sustainable realization of ambitious EU climate goals. This, in turn, serves as an important enabler of financing large projects and risk reduction for increased private sector investment in climate action. Two of the most important key instruments in that regard are Green Bonds and Blended Finance.

4.3.1.1 EU Green Bonds

Green Bonds are fixed-income debt obligations specifically dedicated to supporting projects that deliver environmental gains, notably in adaptation and mitigation of climate change. At the European Union level, Green Bonds have been the instrument of choice with broad financing activities toward a portfolio of climate-related projects, from renewable energy investments to infrastructure built to withstand various climate-related hazards such as flooding and weather extremes. The EU has also emerged as one of the leading supranational issuers of Green Bonds, primarily through its recovery program under NextGenerationEU, which is expected to finance up to €250 billion of the total borrowing via Green Bonds. At that turn of events, the EU emerged as the world's largest Green Bond issuer, a development sending forth strong signals to the capital markets about their new focus on sustainable investment. Proceeds from such bonds are to be used to finance projects consistent with the EU's climate objectives, among which are mitigation strategies like emission reduction and energy efficiency, and climate resilience enhancement for cities and infrastructure. Green bonds work to decrease any viable environmentally friendly project's capital expenditure by ensuring investors a more predictable long-term return. These financial instruments are expected to pull in major institutional investors such as pension funds and insurance firms looking for low-risk investment opportunities with good returns on environmental concerns. These bonds help ensure that the generated proceeds indeed go further to the

[56] https://spain.climate-kic.org/
[57] https://oceans-and-fisheries.ec.europa.eu/funding/emfaf_en

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cause of climate adaptation and mitigation by providing clarity and accountability, in accordance with internationally recognized standards such as the EU Green Bond Standard.

4.3.1.2 CAT Bonds & Parametric Insurance

CAT Bonds (Catastrophe Bonds) and parametric insurance are those mechanisms of finance that apply only to the shifting of risks from severe meteorological events. Both bonds and insurance products provide immediate financing when an event previously defined-which might be a hurricane, flood, or drought, among others-occurs. The main objective of both instruments involves increasing climate adaptation by enabling communities, states, and companies to answer such financial consequences of extreme weather events and to increase their resilience against disturbances in the climate.

4.3.1.3 Blended Finance

Blended finance can use public capital to mobilize private sector investment by absorbing some risks that are associated with projects on climate adaptation. This would be particularly important for financing high-risk, high-impact projects that would not attract private investment due to uncertainties in the technologies associated with climate change or the long-term nature of benefits arising from adaptation. It will help solve the problem of a financing gap in climate change adaptation. Additionally, most adaptation projects and investments have long payback periods and high up-front investments; this acts as a considerable deterrent to many private investors. For example, building flood barriers, constructing heat-resilient urban infrastructure, and restoring ecosystems due to sea-level rise all require large sums of money. Blended finance mechanisms mitigate such risks by aggregating public funds with private capital, therefore making those projects more bankable. In practice, the EU employs blended finance in a number of its initiatives: InnovFin, the European Fund for Strategic Investments, and the European Investment Bank. All of them provide guarantees, loans, and equity finance in order to de-risk investment. This could be the financing of a part of a project through public means, such as concessional loans or grants, while the remaining part is attracted from private investors. This model accommodates far-reaching climate adaptation programs that have access to financing for the development of resilient infrastructure and a reduced vulnerability of key sectors linked with climate change. This also drives innovation in climate adaptation as private companies will have the motivation to invest in the most modern, state-of-the-art technologies and solutions. This is a chance for partnership among governments, private enterprises, and financial institutions in making the adaptation financing ecosystem even more dynamic and responsive.

4.3.1.4 Synergies and Opportunities

Thus, in the perspective of climate adaptation, development of collaborative synergies among various stakeholders is to become imperative with further efforts made by the European Union. In addition, coordination of actions at national, regional, and European levels will also form an important part of any effective implementation of climate adaptation strategies across all the member states. An important strategy in this direction has been seen in the actions enhancing the cooperation between public and private sectors put together with that between different levels of governance.

4.3.1.5 Public-Private Collaboration

Adaptation: PPPs are increasingly being recognized as an important vehicle for reducing the financing gap related to adaptation. Under the PPP approach, the public entities could thus draw on the resources and know-how of the private sector in mobilizing large-scale adaptation activities. This is of even more importance in the context of infrastructure projects, which include but are not limited to cases where funding from purely public sources is likely to fall far short of substantial financial needs.
For example, governmental bodies define the regulatory framework and supply preliminary finance, while private enterprises provide specialized knowledge on project management, engineering, and financial

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support. Adaptation undertakings in this manner secure efficiency and innovation from the private sector, in tandem with strategic long-term planning and stability from the public bodies. Therefore, besides risk and reward sharing, PPPs can offer an enabling environment for private investments in the provision of public goods that entail climate-resilient infrastructures that are central to long-term community sustainability.

4.3.1.6 Cross-Sectoral Synergies

That is, the mainstreaming of climate adaptation activities in the energy, transport, agriculture, and urban development sectors opens enormous opportunities for advancement. Most of the challenges of climate change bear strong inter-relationships; that is, adaptation action across one sector can spill over to other sectors in a positive manner. In specific terms, investments in sustainable urban planning give a city resilience to various types of climate risks—from heat waves to flooding—by enhancing energy efficiency and cutting on carbon emissions, adding to the general climate mitigation goals. The European Union supports intersectoral collaboration through initiatives such as the Circular Cities and Regions Initiative and the European Urban Initiative. They form a formal setting in which municipalities and regions will work in concert on one-stop-shop solutions regarding climate change mitigation and adaptation, aiming at enhancement of the resilience and sustainability of urban areas. Synergies have been pursued wherever appropriate to ensure that different sectoral policy options are undertaken in an integrated manner with efficiency in implementation and savings in overall cost.

4.3.1.7 Collaboration across governance levels

Therefore, harmonization of national, regional, and local policy with strategies developed at the EU level is key to enhance further the effectiveness of climate adaptation actions. A very relevant example is the ESIF, which acts as a vehicle to channel EU-level finance to support regional and local adaptation projects. This also makes sure that all levels of action on adaptation will be contributing to the delivery of one set of climate objectives through aligning the priorities of those funds with the European Green Deal objectives and the Fit for 55 packages. Additionally, the role of local authorities in the implementation of adaptation measures is hard to overestimate. Municipal governments are very often the first line of response against climate impacts; hence, they are important actors in adaptation planning and execution. In this way, the EU will elaborate adaptation strategies more responsive to the variety of vulnerabilities and needs of regions, thus generally boosting the overall level of resilience in Member States by fostering closer cooperation between local governments and institutions at the national or EU level.

4.3.1.8 Opportunities for Innovation and Growth

It is often argued that the more resolutely the European Union works towards its climate goals, the greater the innovation and economic growth opportunities it offers. Greenering the economy is not climate risk mitigation, yet market- and industry-building and job creation in new markets. The EU can unlock growth in renewable energy, sustainable construction, and nature-based solutions thanks to these investments in climate adaptation.

Consequently, through NCFF, the EIB has been able to finance projects that fuse economic development with ecological sustainability; among them include opportunities for pioneering practice in business on ecosystem restoration, sustainable agriculture, and climate-resilient infrastructure. This way, the European Union will indeed take world leadership concerning climate adaptation and economic transformation by the hand of green entrepreneurship and other innovative activities.

Crucially, it lies based on synergies between public and private stakeholders, multisector approaches, and multilevel governance that would really make the most difference in climate change adaptation. The EU could assist further in bridging the widening gap in adaptation finance through the promotion of innovative approaches, policy harmonization, and financial instruments such as Green Bonds and blended finance to support its member states to develop a resilient future.

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Initiative/Programme	Type	Description	Key Players	Climate Focus
LIFE Programme	Climate Finance Demonstration	Supports climate adaptation through projects on biodiversity, circular economy, and energy transition.	EU Authorities, Public Agencies, SMEs, NGOs	CA
Horizon Europe	Research & Innovation Funding	Provides 5.5 billion for green tech R&D, climate innovation, and cross-sector collaborations.	Research Institutes, Academia, Private Enterprises	Both
EU Innovation Fund	Risk-Sharing Low-Carbon Finance	Funds low-carbon technologies and processes sharing risks with the private sector for adaptation solutions.	Corporations, Tech Firms, Climate Innovators	Both
Recovery and Resilience Facility (RRF)	Grants and Loans	Provides 723.8 billion for green and digital transitions and climate neutrality projects post-COVID-19.	EU Member States, Private Enterprises, Public Institutions	Both
European Green Deal & Fit for 55	Regulatory Framework Climate Law	Establishes EU climate goals for 2030 and 2050 with a focus on adaptation and sustainable finance.	Financial Institutions, Governments, Corporations	Both
Green Bonds	Fixed-Income Finance	Debt instruments used to raise capital for climate-friendly projects.	Commercial Banks, Institutional Investors, Governments	CM
Just Transition Mechanism (JTM)	Transition Assistance	Aims to mobilize 55 billion to support regions reliant on fossil fuels for their green transition.	EU Authorities, EIB, Public Institutions, SMEs	Both
European Investment Bank (EIB) Climate Action	Public Finance	Provides loans and financial products supporting climate resilience, renewable energy projects, and green infrastructure.	Governments, Public Institutions, Private Sector	Both
Connecting Europe Facility (CEF)	Infrastructure Funding	Funds trans-European networks for transport and energy enhancing resilience against climate risks.	Public Authorities, Utilities, Private Enterprises	Both

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European Structural and Investment Funds (ESIF)	Grants and Loans	Provides funding for regional development projects, including climate adaptation and mitigation.	Local Governments, SMEs, Public Institutions	Both
Natural Capital Financing Facility (NCFF)	Financial Instrument	Blends EIB loans with EU budget guarantees for biodiversity and climate adaptation projects.	Commercial Banks, Corporations, NGOs	CA
CAT Bonds & Parametric Insurance	Risk Management	Provide financial protection against extreme climate events by transferring risk to investors.	Insurance Companies, Multinational Corporations	CA
European Climate Pact	Engagement and Awareness	Encourages participation in climate action by individuals and organizations across the EU.	Citizens, NGOs, SMEs, Public Authorities	Both
European Social Fund Plus (ESF+)	Grants for Social & Economic Development	Supports green jobs and skills development, focusing on the green transition.	EU Member States, Regional Governments, NGOs	Both
InnovFin Energy Demonstration Projects (EDP)	Financing Innovation	Supports large-scale demonstration projects for renewable energy and smart energy systems.	European Investment Bank, Corporations, SMEs, Innovators	CM
EU Missions under Horizon Europe	Research & Innovation	Focuses on climate adaptation and resilience-building across Europe.	Research Institutions, Public Sector, Private Enterprises	CA
Cohesion Fund	Grants and Loans	Supports environmental infrastructure and projects in lower-income EU Member States.	Governments, Public Authorities, SMEs	Both
Just Transition Fund (JTF)	Regional Economic Transition Fund	Assists carbon-intensive regions with their green economic transition.	Regional Governments, SMEs, Public Authorities	Both
European Urban Initiative (EUI)	Urban Innovation Grants	Supports innovative urban development projects with a focus on climate resilience.	Local Governments, Urban Planners, NGOs, Private Sector	CA

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Circular Cities and Regions Initiative (CCRI)	Urban & Regional Development	Supports circular economy initiatives in cities and regions to reduce resource use and waste.	Cities, Regional Governments, Public Institutions, Private Enterprises	Both
Climate-KIC	Innovation Accelerator	Largest public-private climate innovation partnership in the EU.	Universities, Research Institutions, Startups, Corporations	Both
European Maritime, Fisheries and Aquaculture Fund (EMFAF)	Blue Economy Grants	Supports sustainable blue economy projects, including climate adaptation.	Fishing Communities, Governments, Environmental NGOs	Both
REPowerEU	Energy Transition Initiative	Aims to reduce dependency on fossil fuels and accelerate the transition to renewable energy.	EU Member States, Energy Sector, Public Institutions, Private Enterprises	Both
Green Deal Industrial Plan	Competitiveness & Industrial Sustainability	Supports EU industries to become more competitive and sustainable.	EU Industries, Corporations, Research Institutions, SMEs	Both
New European Bauhaus	Cultural & Environmental Initiative	Promotes sustainable and inclusive living spaces through architectural and cultural transformation.	Architects, Designers, Urban Planners, Local Governments, Academia	Both

Table 4: Mapping of Initiatives/Programmes for CA

5 Business opportunities on DS and CA Solutions level

The workshops carried out in DS2 and DS3 were structured into two different parts; the first one being a general characterization of the DS and, the second, a more specific overview of the climate adaptation solutions adopted at each region. The latter section of these workshops, which was carried out through the Miro platform, is most relevant for this deliverable given its focus on the identification of business opportunities for each specific solution. The results for the first are included in D6.4.

The criteria to select the CA solutions for the second part of the workshop were agreed with the DS leader and members. Such criteria included specific characteristics of the CA solution itself, for instance it was important that the solution had potential of entering and being close to the market. Also, having a company already involved in a solution was given importance when choosing solutions. As for their TRL, a higher score is preferable as it implies more closeness to final implementation. Lastly, as a relevant criterion, having already contacted potential end-users was considered.

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The interactive exercise that constituted this second part contained a set of questions regarding the topics of financing and policies relevant for each CA solution. To start with, the partners were asked to specify which climate hazard was addressed with the solution being considered (see list of hazards in D6.8). Then, there were more specific questions such as, on the one hand, the identification of key stakeholders relevant for financing each solution. Here, a set of possible options was presented for the partners to choose from, such as the national, regional or local authorities in the public sector and businesses in the private sector as potential stakeholders. Further examples of each type could be given by the respondents.

The other topics discussed were related to the different business models that could potentially be implemented according to the solutions and, lastly, the barriers to access and leverage finance. As for the business models, there were 9 different options available tailored previously by AUEB to the solution and from which partners could type in the opportunities and limitations coming with each of these models. For the last question, different types of barriers were suggested, some examples of which were financial, technological or regulatory, and the respondents were asked to determine whether each barrier was relevant or not considering the specific solution.

In order to give their responses, the partners were given access to the interactive Miro platform including the questions and wrote in their answers through post-it notes. This platform was beneficial for this part of the workshop as it allowed for more personalized answers from the partners to better understand the potential of marketing the IMPETUS solutions. Currently, the results of the workshops carried out with 2 frontrunner DS are presented. In the future, this same methodology is to be repeated for the remaining DS and will be included in D6.7.

5.1 DS2 – Coastal: Coast of Catalonia, ES

5.1.1 Introduction to Climate Adaptation finance in DS2

Over the past years, Catalonia has been actively implementing policies aimed at supporting climate adaptation strategies, given the growing importance of this concept at a global level.

A relevant example of this is the Catalan Strategy for Adaptation to Climate Change 2021-2030[58] (ESCACC30), which is a plan made up of a set of measures that will address climate change and facilitate the adaptation to the new current situation climate-wise. These measures are implemented in different areas, which include the natural environment, socio-economic areas and territorial.

As for the financing for these climate adaptation measures, the Catalonian government has set up a Climate Fund that seeks to finance projects related to climate adaptation. Back in 2021, the first eleven projects that will be financed through this Climate Fund were announced. In total, the capital provided for these first projects amounts to €7.9 million.

Additionally, in the past year, the department of Climate Action called for €35 million in grants for the implementation of mitigation and adaptation projects[59]. These funds come from the Climate Fund and are addressed to support projects executed by councils and municipal entities with regards to adaptation and mitigation.

[58] https://canviclimatic.gencat.cat/ca/ambits/adaptacio/estrategia-catalana-dadaptacio-al-canvi-climatic-2021-2030/index.html
[59] Acció Climàtica convoca 35 milions d'euros e... - Govern.cat

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5.1.1.1 Explanation of the Climate adaptation Solution selection

The CA solutions selection is based on criteria such as the TRL, the closeness to the final end-user and the social and environmental impacts that it can generate. The 3 solutions selected are considered “enabling” solutions, thus, instead of implying a direct solution to CC, they are helping to provide relevant data to facilitate and improve decision-making processes by stakeholders (e.g., policymakers).

5.1.2 Climate Adaptation Solution 1: Satellite-based coastal erosion assessment (LOB)

5.1.2.1 Short description of the solution

The Lobelia (LOB) result is an advisory tool satellite-based designed to provide data of the evolution of the coastal erosion and be able to monitor it and inform spatial planning. Generally, it is addressed to public stakeholders, as they are the ones normally undertaking actions on the coast. This tool is useful for them to know better the hot spots they should tackle and carry out efficient management of the resources available. LOB is actively working on this tool through IMPETUS and other complementary projects. The current TRL of the satellite-based coastal erosion assessment is at 9 and started with an initial level of 8 at the beginning of the project. Additionally, the product list includes information such as the climate impact addressed with such solution, which is coastal erosion, and the adaptation sectors involved. These are coastal management on the one hand, and disaster risk reduction on the other.

5.1.2.2 Climate hazard addressed

The more relevant climate risks that are directly addressed by LOB are marine storms (as a subset of extreme storms), sea level rise and marine storms. In addition, water scarcity is also relevant. Water scarcity is a consequence that will affect the oceans, which in turn will impact the prediction capabilities of the tool because of the reduction of sediments coming for the river. Because of this, this risk is also considered as a highly relevant indirect risk.

The medium relevant risks include floodings and biodiversity loss and low relevant risk consider avalanche increase, temperature increase and fires. Finally, heart diseases are considered irrelevant.

5.1.2.3 Stakeholder mapping for policy and finance

During the interactive exercise of mapping SH in a matrix according to their level of power and interest in their solution, LOB identified 15 SHs. In the first place, the SH that were identified to have the highest interest and power were the companies from the private sector interested in measuring their performance due to the Corporate Sustainability Reporting Directive (CSRD) and the European Sustainability Reporting Standards (ESRS).

There is limited engagement from ports; for instance, they engaged with the port of Tarragona, but not within the framework of the IMPETUS project. Barcelona and Tarragona ports depend on national authorities, making outreach challenging. For some services, beneficiaries are identified, but not the actual paying customers. Research centers focus on collaboration for knowledge development but lack economic interest and power. They haven't engaged with the real estate sector yet but recognize its importance as a potential client. Insurance is a potential sector, but there is no market research or strategy to approach it.

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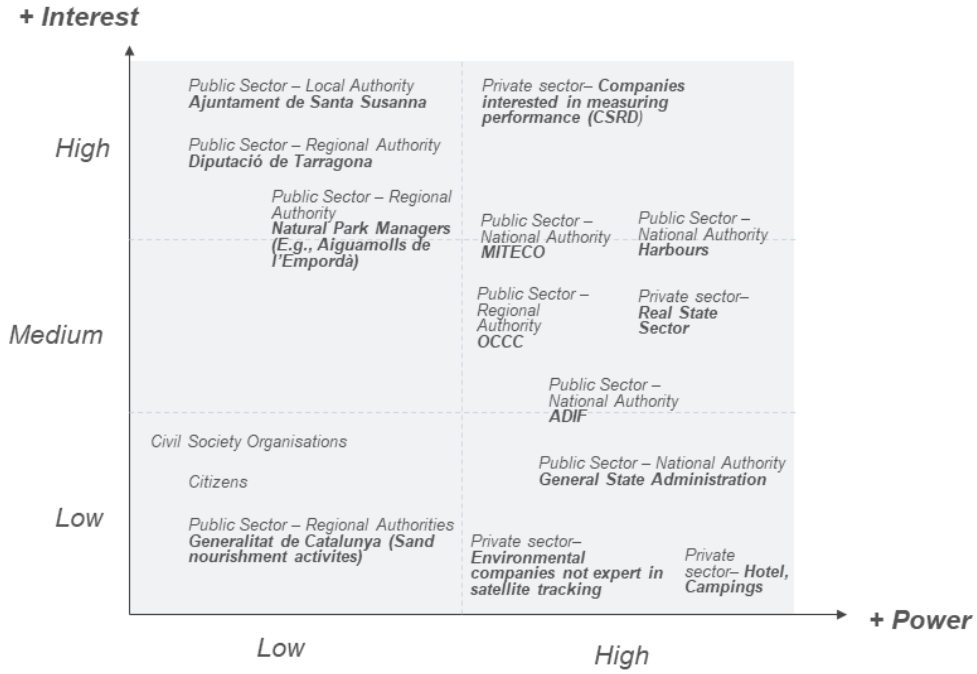

Figure 6: DS2 – CA Solution 1 Matrix of SHs

5.1.2.4 Analysis of business models

Business model	Description	Target audience/clients	Revenue streams
Service subscription model	Customers subscribe to a service providing regular reports and Realtime data on coastal erosion	Government agencies, environmental organizations, insurance companies, coastal property owners and researchers	Monthly or yearly subscription fees
Open-source model (Freemium or advertising)	Offer a basic version of the service for free, with limited features, and charge for premium features such as detailed analysis, historical data and predictive analytics. Basic version supported by advertisements.	General public, educational platforms, and small businesses or individuals who need basic nada, with upsell potential to premium users.	Premium subscription fees, possibility ad-supported free tier.
Data-as-a-service (Daas) model	Provide raw or processed data via an API that can be integrated in other platforms and services.	Tech companies, academic institutions, and other business that require raw data for their own applications	Charges based on data usage, API calls, or a flat fee for data access.
Consulting and custom solutions	Offer specialized consulting services and custom solutions based on specific client needs, such as tailored reports, on-site	Large enterprises, government bodies and NGOs.	Project-based fees, retainer agreements and consulting service charges.

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	assessments, and strategic planning.		
Partnerships and licensing	Partner with other businesses, research institutions and governmental agencies to license the technology or integrate it into broader environmental monitoring system.	Technology firms, government environmental agencies and multinational organizations.	Licensing fees, revenue sharing, or joint ventures (shared ownership, shared returns and risks).
Grants and public funding	Secure funding through grants from governmental and non-governmental organizations focused on environmental protection and CC mitigation.	Environmental protection agencies, international organizations and philanthropic foundations.	Grant funds, public funding and donations.
White-label solutions	Develop the technology for other companies to rebrand and offer as part of their product suite.	Environmental consulting firms, technology companies and research institutions.	White-label licensing fees (innovator leases or rents the unbranded SW)
Educational and training services	Provide educational content, training programs and workshops on coastal erosion assessment and the use of satellite data for monitoring environmental changes.	Universities, schools, training institutes and professional organizations.	Fee for courses, workshops and training programs.
Insurance model	Partner with insurance companies to provide data that help assess risks and determine premiums for coastal properties.	Insurance companies, property developers and coastal property owners.	Fees from insurance companies for data and risk assessment services.

Table 5. DS2 - CA solution 1 Business model description

Business model	Advantages	Disadvantages	Other comments
Service subscription model	Offering different subscription tiers can attract a wider range of customers, from individuals to large organizations.	Established companies might already be providing similar services, making it challenging to gain market share.	//
Open-source model (Freemium or advertising)	//	The private sector has not adopted this model recurrently, making it difficult to see its success.	Although possible, this model is not preferred by Lobelia and would not work for the Coastal DS.
Data-as-a-service (Daas) model	This model aligns clearly with the current tool.	//	//
Consulting and custom solutions	This is usually LOB primary business model.	Requires significant personnel effort, making it non-scalable.	//

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Partnerships and licencing	ESRS reporting involves specific players who need expert inputs for climate and other physical risks.	//	//
Grants and public funding	Selling under Lobelia's brand helps build trust.	Clients doubt the continuity of a service originating from an EU project.	//
White-label solutions	Engineering companies not expert in satellite technology often purchase data for projects and might potentially buy data from LOB.	//	//
Educational and training services	Enhances visibility and communication.	This service alone would not be self-sustainable.	Currently, it is not a priority for LOB.
Insurance model	This is an avenue being explored.	//	//

Table 6. DS2 - CA solution 1 Business model analysis

The previous Table 5 displays all the different business models proposed for this solution, including its target audience and revenue streams. Then, as seen in Table 6, which includes the analysis of each business model made by the partners during the workshop, they have not fully considered an open-source model because the data is annual, and they are not sufficiently aware of how to make it profitable. Only municipalities care about the size of the beach, but they lack funding. Consultancy is seen as a preliminary step to learn, but for profitability and scaling, they are looking at a data-as-a-service model. Educational and training services focus more on communication channels to attract spin-offs. The partners noted that universities are increasingly involved, providing many opportunities. Lobelia engages in participatory communication, led by Isadora, but it is not the main focus of the company.

5.1.2.5 Barriers to access and leverage finance for solutions

Venture capital is risky due to its dynamic nature. There is no slower way to access and increase a company's value compared to traditional methods. Lengthy and complex approval processes are especially common in municipalities. There is a policy gap where those who understand user needs lack power, and decision-makers do not fully understand the users. Satellite solutions are often perceived as expensive. While the market size is high and many could benefit, there are limited stakeholders who recognize these benefits. Many clients do not understand the inherent uncertainty in data, leading to misaligned expectations. Companies with more advanced technology are more likely to adopt and see the value in Lobelia’s services. Integration is generally not a problem as many are already well-integrated with systems like Copernicus. High R&D costs and a lack of resources to finance satellite technology are significant challenges. Companies depend on European funding, which is often directed towards universities rather than direct technological development. National funding, such as the Next Generation funds, primarily covers personnel costs rather than direct R&D. European researchers are better compensated than those funded by the Spanish government, resulting in less participation in national projects for technology development

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5.1.3 Climate Adaptation Solution 2: Water quality prediction Tool on bathing areas and under severe storms (EUT)

5.1.3.1 Short description of the solution

This CA solution focuses on developing a Water Quality Prediction Tool to enhance public safety and environmental management in bathing areas. It is led by EUT. This tool is designed to help decision-makers and local authorities assess the safety of water for recreational use during and after severe storm events, where water quality can be compromised. By predicting potential contamination risks, the tool aids in making informed decisions on whether to permit or restrict bathing in specific areas.

In addition to supporting authorities, the tool has the potential to be adapted into a user-friendly mobile application, allowing the public to access real-time information on water quality. This feature would enable bathers to determine if it is safe to enter the water after rain or storm events, promoting public health and awareness. The initial TRL is 6 and the final TRL is 7.

5.1.3.2 Climate hazard addressed

After severe storms, water treatment plants in the Catalan DemoSite (DS) are not able to collect all the rainwater and they collapse. The water quality prediction tool on bathing areas allows us to predict water quality after an overflood and understand how it is affected. This relevant information would be directly provided ideally on a real-time basis to the authorities involved, in order to monitor it. This tool would be relevant for the bathing areas, so that authorities and citizens could access the information (e.g., via an app, platform, flag on the beach, etc.

5.1.3.3 Stakeholder mapping for policy and finance

During the interactive exercise, several stakeholders were considered as important in this specific solution.

To start with, the stakeholders considered to have the highest interest and power were from the public sector: the municipalities and the ACA, the Catalan Agency of Water. At lower levels of interest but relatively high power, the stakeholders considered were the Catalan government, named “Generalitat de Catalunya”, universities and water operators. The MITECO, which stands for the Ministry for the Ecological Transition and the Demographic Challenge, was also considered as a relevant actor. Lastly, the stakeholders considered to have a lower level of interest were journalists and communicators, as well as the sustainable tourism sector, with different actors such as hotels and camping's.

The following figure depicts this question in the Miro workshop, together with the solutions from the partners. With the use of sticky notes, the respondents specified the levels of both interest and power of the different actors and provided examples of relevant stakeholders for the water quality prediction tool.

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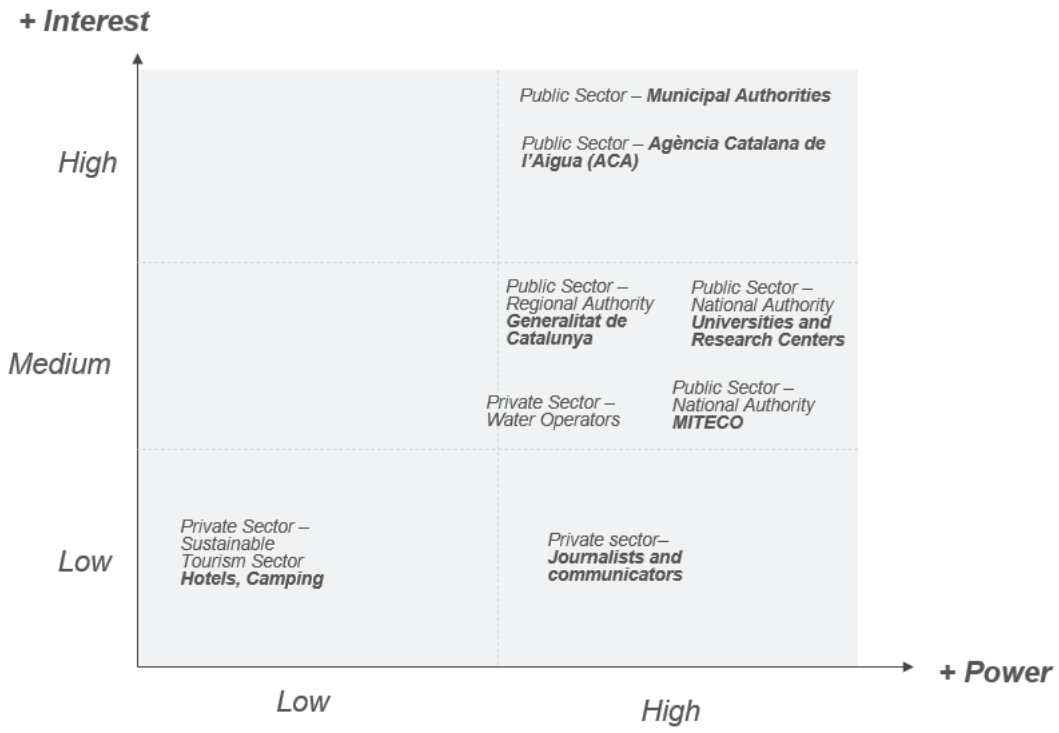

Figure 7. DS2 – CA Solution 2 Matrix of Stakeholders (SHs)

5.1.3.4 Analysis of business models

Business Model	Description	Target Audience / Clients	Revenue Streams
Service Subscription Model (Emergency Management Subscription Model)	Real-time monitoring and prediction of water quality during severe storms.	Local governments, environmental agencies and tourism operators need regular updates on water quality.	Monthly or yearly subscription fees.
Open-Source Model (Freemium or advertising)	Offer a basic version for free with limited features, and charge for premium features such as detailed analysis, historical data and predictive analytics.	General public, educational platforms and SMEs or individuals who need basic data, with upsell potential to premium users.	The free version is supported by advertisements. Charge for advanced features.
Environmental Monitoring as a Service (EMaaS)	Offer water quality monitoring and prediction as a service to businesses and organizations with environmental monitoring needs.	Industrial facilities, agriculture, fisheries, environmental consultancies.	Customized service packages based on client needs.
Consulting and custom solutions	Offer specialized consulting services	Local authorities and businesses.	Project-based fees, retainer agreements

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	and custom solutions based on specific client needs, such as tailored reports, on-site assessments and strategic planning.		and consulting service charges.
Licensing	License the water quality prediction technology to third-party companies or governments for use in their own systems.	Government agencies, larger environmental monitoring companies, international bodies.	Licensing fees, revenue sharing or joint ventures (shared ownership, shared returns and risks).
Public safety and community resilience model	Partner with local governments and community organizations to provide water quality prediction services for public safety and community resilience.	Local governments, community organizations, neighborhood associations.	Community outreach and education on water quality risks during severe storms. Public awareness campaigns and preparedness initiatives. Collaboration with local authorities for emergency response planning. Grant funds, public funding and donations.
Corporate social responsibility (CSR) partnership model	Partner with corporations as a part of their CSR initiatives to support community resilience and environmental sustainability.	Corporations with CSR programs, especially those in coastal areas or with environmental interests.	Co-branded initiatives and community outreach programs. Sponsorship of water quality prediction services for vulnerable communities. Corporate funding for R&D projects.
Insurance model	Provide water quality risk assessment services to insurance companies, property developers and infrastructure operators.	Insurance companies, property developers, infrastructure operators.	Fees from insurance companies for data and risk assessment services. High-value service for risk mitigation, potential for premium pricing.

Table 7. DS2 - CA solution 2 Business model description

Business model	Advantages	Disadvantages	Other comments
Service subscription model (Emergency management subscription model)	Offering different subscription tiers can attract a wider range of customers, from individuals to large organizations.	Potential existence of already established companies in the market offering similar services.	ACA could use it.

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Open-source model (Freemium or advertising)	Two main users: bathing users (free but limited service) and municipalities (personalisation of the service). For municipalities: Simulation of different scenarios (risk linked and impact for the bathing areas).	//	ACA could implement it in several regions along the coast but, for water operators, there is a limited scope.
Environmental monitoring as a service (EMaaS)	//	Needs proper monitoring.	//
Consulting and custom solutions	//	All users need initial training. Different specifications depending on the region. Initial support needed.	//
Licensing	//	Many Intellectual Property (IP) concerns that would impede the licensing.	//
Public safety and community resilience model	//	//	Not a purpose
CSR partnership model	//	//	Not probable
Insurance model	//	//	Exploration still needed

Table 8. DS2 - CA solution 2 Business model analysis

Among the different business models proposed for this specific solution, three were considered not applicable: licensing, a corporate social responsibility (CSR) partnership model and an open-source model. The first one is due to intellectual property concerns that could potentially impede the licensing and, as for the second one, it was considered not probable to find partners to carry out CSR initiatives. Thirdly, the open-source model could not be applied as the scope is very limited for water operators.

All the other business models initially proposed were considered applicable. However, for insurance, it was commented that exploration is still needed. Additionally, the respondents included some opportunities and limitations to the different proposed business models, all included in Table 6.

Considering the service subscription model, an opportunity includes the ability of attracting a wider range of customers by offering different subscription tiers. However, limitations were also mentioned, which included the presence of established companies providing similar services in the market, making it challenging to gain market share.

As for environmental monitoring as a service, one of its limitations is that it requires proper monitoring for it to be useful.

Lastly, for the consulting and custom solutions, the limitations were related to different specifications according to the different regions and the initial training and support needed by all the users.

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5.1.3.5 Barriers to access and leverage finance for solutions

The last part of this interactive activity was regarding the identification of several barriers that could make access to financing more difficult for the solution in question.

Among the options included, the most challenging barriers according to the respondents were regulatory. For instance, it was mentioned that approval systems are lengthy and complex and that there is a lack of incentives of the local end-users, such as water operators or municipalities.

As for financial barriers, the high initial capital requirements were considered relatively less significant than the ones mentioned previously, though still relevant, nevertheless. At this medium level of relevance, there are also market, technological and institutional barriers. Market barriers include competition from already established tech companies, and an awareness and information gap. Additionally, reaching the municipalities is difficult due to the existence of different levels of knowledge. Moving on to technological barriers, the ones mentioned were related to compatibility of the innovative technologies in relation to the existing systems and high R&D expenses required to enter these innovations into the market. The institutional barriers included at this level were regarding coordination and collaboration between different institutions and stakeholders, with a specific example being between the municipalities and the ACA. The different competences of the different stakeholders could also pose a significant barrier.

Lastly, at the lowest level of relevance, there are several financial barriers such as insufficient financial instruments and access to capital markets, which may be difficult. In the regulatory perspective, the barrier included was with regards to inconsistent and unclear policies and, as for market barriers, the existence of niche markets may also pose challenges. In the technological framework, the uncertainty and risk implied by the new technologies was considered as a barrier. Then, ending with the institutional barriers, the ones included in this level were related to the capacity and low know-how of the developers of the technology to enter it into the market and attract investors, as well as institutional inertia, in the sense that municipalities may be more precautious and reactive to implementing new solutions.

5.1.4 Climate Adaptation Solution 3: Tools and Methodology to improve drinking water system resilience (EUT)

5.1.4.1 Short description of the solution

This solution will support water utilities (e.g., Aigües de Manresa), water operators and municipalities to be aware of the water source for drinking water production and consider water treatment strategies to ensure water quality or potable uses. It is being developed by the EUT team. This tool will help to predict the weather (early warning system) and readapt drinking quality on the tap. This way, the tool will be able to predict what can harm and improve prevention. The TRL for this solution is currently 6, as opposed to an initial level of 4 at the start of the IMPETUS project.

5.1.4.2 Climate hazard addressed

The most relevant climate hazards addressed with this solution are water scarcity, extreme storms and temperature rise. Also, at a medium level of relevance, health diseases are also addressed.

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5.1.4.3 Stakeholder mapping for policy and finance

In this case, during the interactive exercise, the different stakeholders that were considered most relevant were, on the one hand, local communities such as neighbors in the areas where this solution is to be implemented. On the other hand, key players include municipalities and non-governmental organizations (NGOs). More specifically, in municipalities, those responsible for human health have a higher interest in this solution and, as for NGOs, some examples would be the Surfrider Foundation [60]and the Good Karma Project[61].

At a medium level of interest, the stakeholders included were the European Commission, the Catalan government and the Spanish government, inside which there is the Ministry for the Ecological Transition and the Demographic Challenge.

Lastly, the stakeholders with lower interest and power are sustainable tourism destinations, such as hotels and camps.

The following graph depicts the results of the stakeholder mapping exercise carried out during this workshop with DS2 partners.

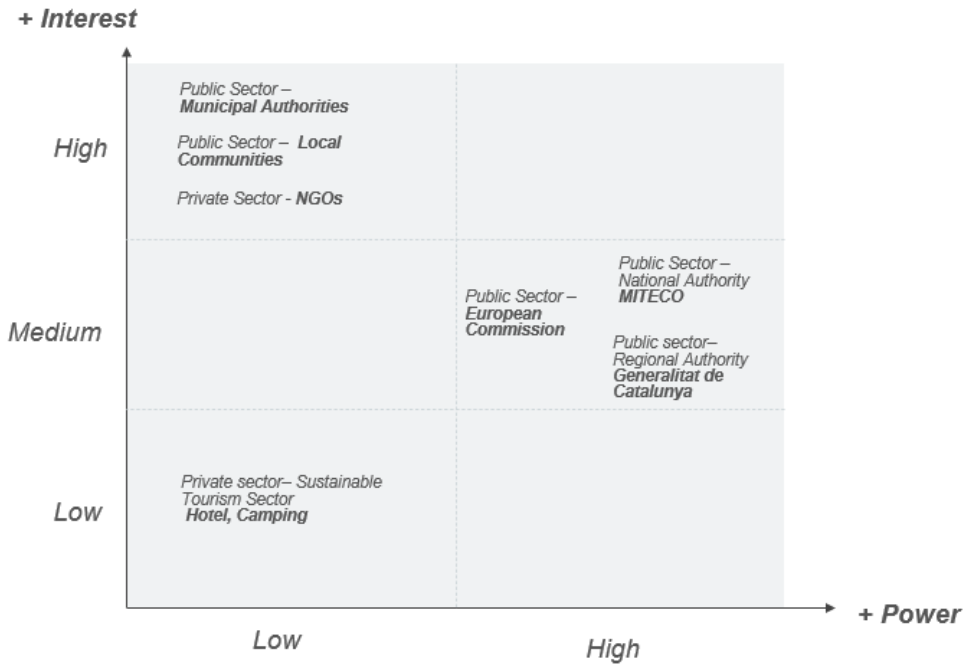

Figure 8. DS2 – CA Solution 3 Matrix of SHs

5.1.4.4 Analysis of business models

Business model	Advantages	Disadvantages	Other comments
Service subscription	Offering different subscription tiers can attract a wider range	The subscription fees can add up to a low sum as	//

[60] https://www.surfrider.org/
[61] https://goodkarmaprojects.org/

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model (Emergency management subscription model)	of customers, from individuals to large organizations.	revenue streams. Restrictions due to the type of organization (Eurecat). Existence of already established companies in the market.	
Open-source model (Freemium or advertising)	Two main users: bathing users (free but limited service) and municipalities (personalization of the service). For the municipalities: it can offer a simulation of different scenarios (risk linked and impact for the bathing areas).	//	//
Environmental monitoring as a service (EMaaS)	//	//	//
Consulting and custom solutions	//	All users need initial training. Different specifications depending on the region. Initial support needed.	//
Licensing	//	Many IP concerns would impede the licensing.	//
Public safety and community resilience model	//	//	Not a purpose
CSR partnership model	//	//	Not probable
Insurance model	//	//	Exploration still needed

Table 9. DS2 - CA solution 3 Business model analysis

The set of business models proposed for this solution were the same as for the CA solution 2, described in Table 7.

Also, similarly to the previous solution, the two business models not applicable are licensing, due to intellectual property concerns, and a CSR partnership model, due to the unlikeliness of finding corporations to partner with for carrying out CSR initiatives. The open-source model is considered applicable for this solution, although it was not for the previous one.

As shown in Table 9, regarding opportunities and limitations, these were all like the water quality prediction Tool solution. In the service subscription model, additional limitations were mentioned. Regarding the revenue streams, subscription fees might add up to a low sum in total and, additionally, further restrictions could arise given the type of organization that is Eurecat.

5.1.4.5 Barriers to access and leverage finance for solutions

Given the location and the nature of the solution, and its similarity to the CA solution 2 in DS2, the barriers to access and leverage finance are also very similar.

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5.2 DS3 – Mediterranean: Region of Attica, GR

5.2.1 Introduction to Climate Adaptation finance in the region of Attica (Greece)

Given the increasing relevance of CC and the importance of implementing further measures for mitigation and adaptation, the Bank of Greece has been actively involved in financing these types of measures. In 2009, the Climate Change Impacts Study Committee (CCISC) was created, which is aimed at conducting research and activities in order to find the appropriate policies to implement for addressing climate change. More recently, in 2021, another organization was set up by the Bank of Greece: The Climate Change and Sustainability Centre (CCSC). Its main objective is to give support to climate and sustainability activities and actions organized by the Bank or the CCISC.

Other forms of financing for climate change in Greece are in the form of loans from the European Investment Bank (EIB). More recently, the country received a significant loan for vital investments, some of which have the objective of contributing to the reduction of carbon emissions or improving environmental protection, among others.[62]

Research conducted by the CCISC[63] shows that, apart from mitigation measures that have been more widely implemented, adaptation is also essential for minimizing the climate change impacts on the Greek economy. Additionally, it was estimated that investing in climate adaptation could help in lowering the cost of climate change by approximately 30%.

Some of the climate change measures implemented in Greece include the National Energy and Climate Plan (NECP) and the National Climate Law, which set targets to reduce emissions in order to reach their main objective of achieving net zero emissions by 2050.[64]

5.2.1.1 Explanation of the Climate adaptation Solution selection

The selection of the 2 CA solutions for DS3 is based on their high TRL and their strong network of SHs in order to ensure the deployment and financing of the results. PPP is considered a probability with a high chance. Moreover, the SCBA has also been performed for both solutions and they are key for the CA strategies of the regions.

5.2.2 Climate Adaptation Solution 1: Sewer Mining Technology

5.2.2.1 Short description of the solution

The sewer mining technology is an innovative and highly replicable water reuse system which is made more specifically for arid urban environments such as the Mediterranean. It is a modular and compact wastewater treatment station and, as for its functioning, the wastewater is extracted from local sewers, it is treated directly on site, and it is then either reused according to demand or stock reserved for when needed. The added value of this technology is the fact that it addresses water scarcity issues in a dense urban environment by transforming treated wastewater into supply. This in turn increases urban

[62] Greece: EIB confirms €900 million of support for vital investments in public sector to finance social cohesion, sustainable urban regeneration, and a just transition toward climate neutrality
[63] Climate change and the economy (bankofgreece.gr)
[64] Executive summary – Greece 2023 – Analysis - IEA

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resilience to climate change and provides tangible and tested measures for adaptation schemes and actions.

5.2.2.2 Climate hazard addressed

Based on the information gathered from the interactive exercise, the most relevant climate risks addressed with this sewer mining technology are related to water scarcity, biodiversity loss and agricultural productivity.

At the medium level of relevance, the climate risks included were more related to inconsistencies in the level of temperatures and the frequence of storms. They can be temperature increase, marine storms and extreme storms. Another medium-low climate risk mentioned during the session was heart diseases.

5.2.2.3 Stakeholder mapping for policy and finance

Starting with the stakeholders with the most interest in the sewer mining technology but with a lower degree of power, local authorities and NGOs were identified. Furthermore, at the same level of interest but higher power, there are private companies and universities, such as the Athens University of Economics and Business (AUEB) and the National Technical University of Athens (NTUA).

Moving on to the stakeholders considered to have a relatively lower interest in the technology, these include the Attica Prefecture and regional authorities as well as the local community in the section with lower levels of power. On the other side, with higher power, the stakeholders included during the exercise were the National Bank of Greece, Ministries from the public sector, an example of which could be the Ministry of Environment.

Lastly, at the lowest levels of interest, the stakeholders considered were municipalities with lower power, and national authorities with a higher degree of power.

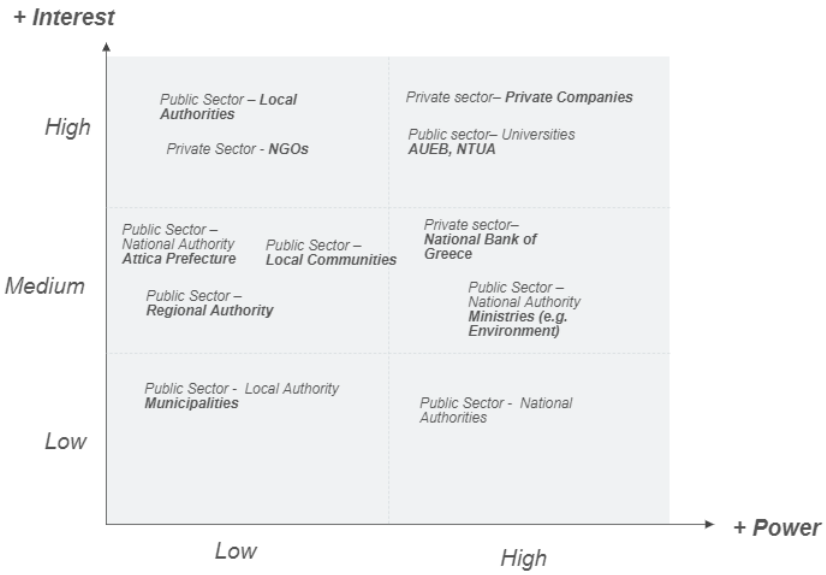

Figure 9. DS3 – CA Solution 1 Matrix of SHs

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5.2.2.4 Analysis of business models

Business model	Description	Target audience / clients	Revenue streams
Product sales model	Selling sewer mining units directly to customers.	Municipalities and local governments, industrial facilities, agricultural operations, commercial and residential developments.	One-time sales, extended warranties, maintenance contracts.
Service subscription model	Provide installation, operation and maintenance services for a recurring fee.	Industrial facilities, commercial and residential developments, agricultural operations, large-scale infrastructure projects.	Monthly or annual subscription fees, additional charges for maintenance or upgrades.
Build-Own-Operate-Transfer (BOOT) model	Financing, constructing, owning and operating sewer mining units before transferring ownership to the client after a specified period.	Municipalities and local governments, large industrial facilities, commercial developments, infrastructure projects.	Long-term service contracts, initial financing fees, eventual transfer fees.
Public-Private Partnership (PPP) model	Collaboration between government entities and private companies to develop and operate sewer mining projects.	Municipalities and regional governments, public infrastructure projects.	Shared investment, user fees, government subsidies, potential revenue-sharing agreements.
Resource Recovery model	Recovering valuable resources (e.g. nutrients, energy, metals) from wastewater and selling them.	Industrial facilities, agricultural operations, environmental agencies, resource recovery companies	Sale of recovered materials (e.g. biogas, phosphorus, nitrogen), service fees for waste treatment.
Consulting and engineering services model	Providing design, optimization and implementation consulting for sewer mining projects.	Municipalities and local governments, industrial facilities, large commercial developments, infrastructure projects.	Consulting fees, engineering design contracts, technical support services.
Data and analytics model	Offering data collection and analytics services related to the operation of sewer mining units.	Municipalities and local governments, industrial facilities, commercial and residential developments, agricultural operations	Subscription fees for access to analytics platforms, fees for detailed reports and consultancy based on data insights.
Leasing model	Leasing sewer mining units to clients who	Municipalities and local governments, small to	Monthly or annual lease payments,

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	prefer not to make a large upfront investment.	medium-sized industrial facilities, commercial and residential developments, agricultural operations.	additional service fees for maintenance and upgrades.
Pay-per-use model	Charging clients based on the volume of wastewater treated or the amount of reclaimed water used.	Industrial facilities, commercial and residential developments, agricultural operations, infrastructure projects.	Usage-based fees, offering flexibility for clients with varying water needs.
Hybrid model	Combining elements of the above models to offer a tailored solution to clients.	Municipalities and local governments, industrial facilities, large commercial developments, infrastructure projects, agricultural operations.	Combination of lease payments, subscription fees, and additional service charges.

Table 10. DS3 - CA solution 1 Business model description

Business model	Advantages	Disadvantages	Other comments
Product sales model	//	Many technical and operational issues need to be solved on site.	//
Service subscription model	Setting a fixed fee for operation and maintenance of the sewer mining unit will make it sustainable.	//	//
Public-Private-Partnership (PPP) model	Enhances collaboration between private companies and authorities for the installation (permits) and operational phase (startup). Streamline procedures.	Lack of regulatory framework flexibility.	//
Data and analytics model	The data collected through an online platform can optimize the operation of the sewer mining unit and reduce energy needs. Analytics to gather evidence on efficient management of resources.	//	//

Table 11. DS3 - CA solution 1 Business model analysis

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Several distinct business models were proposed for this specific solution, which have been described in Table 10. Then, Table 11 includes the analysis made during the workshop.

When considering them, three were identified as not applicable: the product sales model, the leasing model and the pay-per-use model. The first one, which consisted of selling the sewer mining technology directly to the customers, had limitations regarding technical and operational issues that would have to be solved on site. On the other hand, the leasing model was based on leasing sewer mining units to those clients who prefer not to make a large upfront investment and, lastly, the pay-per-use model would charge clients based on the volume of wastewater treated or the amount of reclaimed water used.

All the other models were considered to be applicable for sewer mining technology. However, some presented several limitations or opportunities worth mentioning.

For example, starting with the service subscription model, an opportunity considered during the interactive exercise is setting a fixed fee for the operation and maintenance of the sewer mining unit in addition to the other revenue streams that were already contained in the initial description model.

Moving on to the public-private partnership (PPP) model, a potential opportunity that was mentioned was in relation to the nature of the model itself, as it encourages more collaboration between private companies and authorities for the installation of the sewer mining technology, as well as for its operation. For example, it was mentioned that, through this collaboration, the permits for installing the technology were more easily obtained. Additionally, another opportunity of this model is the streamline procedures, which allow to improve the efficiency of the model by simplifying or eliminating non-essential tasks. However, one of limitations of this model was regarding the regulatory framework, which lacks flexibility in order to facilitate this collaboration.

Furthermore, the data and analytics model consist of offering data collection and analytics services related to the operation of sewer mining units and, some of its opportunities are related with being able to optimize the operation and to reduce energy needs through the data collected from an online platform. Additionally, performing analytics can also enable to gather evidence on efficient management of resources.

The following figure demonstrates a section of the Miro workshop, where the respondents were asked to drag the green and pink notes to the proposed business models, depending on whether they considered each model to be applicable or not, respectively. Additionally, at the right side of the table, the partners had the option to specify limitations, in pink, or opportunities, in green, for each model.

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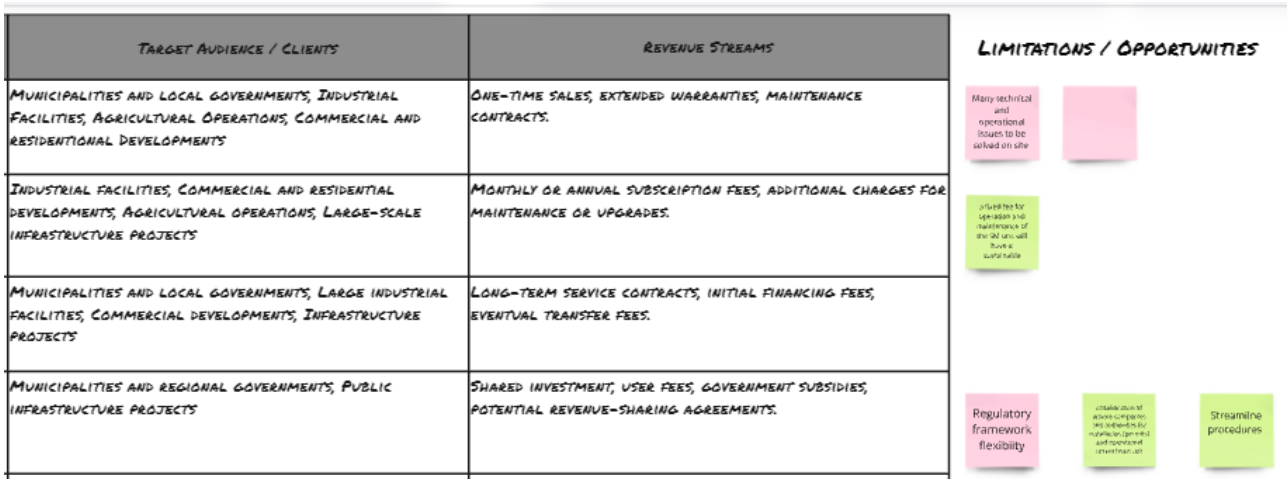

Target Audience / Clients	Revenue Streams
Municipalities and local governments, Industrial facilities, Agricultural operations, Commercial and residential developments	One-time sales, extended warranties, maintenance contracts.
Industrial facilities, Commercial and residential developments, Agricultural operations, Large-scale infrastructure projects	Monthly or annual subscription fees, additional charges for maintenance or upgrades.
Municipalities and local governments, Large industrial facilities, Commercial developments, Infrastructure projects	Long-term service contracts, initial financing fees, eventual transfer fees.
Municipalities and regional governments, Public infrastructure projects	Shared investment, user fees, government subsidies, potential revenue-sharing agreements.

Figure 10. Business model results from DS3 workshop

5.2.2.5 Barriers to access and leverage finance for solutions

In the last part of the interactive exercise, information was gathered regarding the identification of different types of barriers to access and leverage finance for the sewer mining technology solution.

Starting with the law, including the most important barriers to be considered, and inside the financial ones, there are the high initial capital requirements, the insufficiency of financial instruments and the difficult access to capital markets. As for regulatory, it was mentioned that the approval systems are lengthy and complex, leading to a more difficult implementation of the project, and that the policies are inconsistent and unclear which in turn increases uncertainty when investing. The most important market barriers are related to information and awareness gaps, and the high R&D expenses constitute technological barriers. Lastly, the most relevant institutional barriers contain problems with coordination and collaboration, as well as institutional inertia when it comes to adopting new practices.

Other barriers that are relatively less important but still worth considering are the lack of incentives such as subsidies or grants, which are categorized as regulatory barriers. Additionally, the existence of niche markets, with limited size, and the competition from already established firms can also hinder the implementation of the solution in the market. As for the technological barriers, the ones mentioned were the high uncertainty and risk, leading to increased hesitation when investing in the solution, and compatibility issues that arise from integrating the new technology into existing systems. These were also considered at low relevance, due to recent developments and research that have potentially led to less uncertainty, as well as less compatibility issues. Regarding institutional barriers, there is a limited capacity of developers to create projects that attract investors.

5.2.3 Climate Adaptation Solution 2: Water Reuse Masterplan and Business Plan

5.2.3.1 Short description of the solution

The Water Reuse Masterplan and Business Plan is aimed at addressing water scarcity and drought in Eastern Attica through the optimization of the usage of water resources. It is based on advanced Sewer Mining (SM) technology and enhances efficiency and sustainability in water reuse. Additionally, the business plans allow for the continuity and long-term viability of this solution.

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5.2.3.2 Climate hazard addressed

Among the given possible options, the partners specified that the main climate hazard addressed with the Water Reuse Masterplan & Business Plan is water scarcity. At a medium level of relevance, the climate hazards considered were both temperature increase, biodiversity loss and fires in the sense that these could be prevented by reusing water. Finally, at the lowest relevance, flooding risk and heart diseases were included. On the other hand, some climate hazards were considered not to be relevant at all, as is the case for sea level rise, and both marine and extreme storms.

5.2.3.3 Stakeholder mapping for policy and finance

When considering the stakeholders with the highest interest in the solution, the partners identified regional authorities such as the Decentralized Administration of Attica on the one hand and, on the other, national NGOs. However, despite showing the highest interest, both stakeholders were situated at the lower power level.

Moving on to the part of the matrix for medium interest, the Academia sector was considered. In such sector, some specific stakeholders were identified, such as the National Technical University of Athens (NTUA), the Athens University of Economics and Business (AUEB) and the Agricultural University of Athens. As for the private sector, the respondents considered that SMEs were important for the solution, especially those dedicated to engineering or innovation. Then, the local authorities were also identified as potential stakeholders, specifically in the form of Municipalities of eastern Attica.

Among those stakeholders with medium interest in the solution but higher power, the Ministry of Environment and Energy was considered. According to the partners, the reason for allocating ministries in medium interest was due to the difficulty of getting them involved in the solution. Additionally, both public and private water companies were assigned at these levels of interest and power. A specific example of a potential stakeholder is EYDAP, as it constitutes an important company in the Greek water sector.

The following figure depicts the stakeholder mapping exercise carried out during the workshop, and the results given by the partners.

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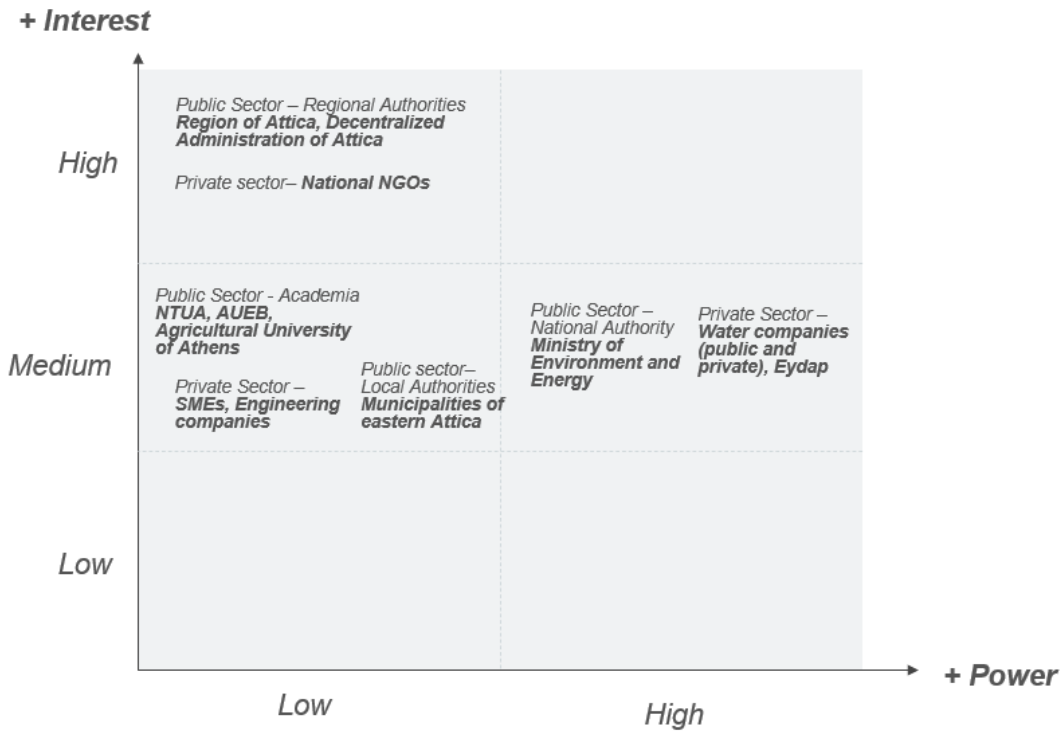

Figure 11. DS3 – CA Solution 2 Matrix of SHs

5.2.3.4 Analysis of business models

Business model	Description	Target audience / clients	Revenue streams
Subscription-based service model	Offer a solution as a subscription service, such as the rainwater harvesting, including system installation, maintenance, monitoring and water quality testing.	Residential communities, commercial properties, schools and educational institutions.	Monthly or annual subscription fees. Additional fees for enhanced services (e.g. water quality testing, system upgrades). Optional insurance or warranty plans.
Leasing model	Lease systems to customers, allowing them to use the equipment without the need for a large upfront purchase. Such systems can be for rainwater harvesting or for gray water recycling, for example.	Small to medium-sized businesses, agricultural operations, residential communities.	Monthly or annual lease payments. Fees for optional maintenance and service packages. Buyout options at the end of the lease term. Late fees or penalties for lease term violations.
Pay-per-use model	Charge customers based on the amount of water used, making it a variable cost rather	Industrial facilities, agricultural operations, large commercial complexes.	Per-liter or per-gallon fees based on water usage. Additional charges for data

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	than a fixed investment.		analytics and usage reports. Steup fees for installing monitoring equipment. Tiered pricing for different usage levels.
Public-Private Partnership (PPP) model	Collaborate with water agencies to implement large-scale water systems in public infrastructure projects. Such systems can be for rainwater harvesting or for gray water recycling.	Municipalities and regional governments, public institutions (e.g. schools, hospitals)	Government grants and subsidies. Long-term service contracts. Revenue sharing from water savings or resources recovery. Payments for project management and operation.
Resource recovery model	Focus on recovering and selling water resources and offering additional services such as irrigation or greywater reuse.	Agricultural operations, industrial facilities, commercial properties with high water usage.	Sale of purified or treated water. Fees for irrigation or greywater reuse services. Sale of byproducts (e.g. minerals from water treatment). Subscription or service fees for ongoing resource management.
Consulting and engineering services model	Provide specialized consulting and design services for custom water systems, particularly for large-scale or complex projects. They can be greywater recycling systems or rainwater harvesting, for instance.	Large commercial developments, industrial facilities, government projects, educational institutions, agricultural operations.	Consulting fees for project planning and design. Engineering and design contracts. Fees for regulatory compliance support. Ongoing revenue from maintenance and support contracts. Training fees for client staff on system operation.
Community-based cooperative model	Form cooperatives in residential areas or small communities to collectively invest in water systems, sharing costs and benefits.	Residential neighborhoods, small rural communities, eco-villages and intentional communities.	Membership fees for cooperative participation. Shared costs for system installation and maintenance. Revenue from bulk purchase discounts and government subsidies. Potential income from selling excess harvested water to non-members.

Table 12. DS3 - CA solution 2 Business model description

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Business model	Advantages	Disadvantages	Other comments
Subscription-based service model	If a water company invests in strategic series of units, then the subscription of the municipalities facing water scarcity issues will make a lot of sense (Green spaces, cleaning…).	//	//
Leasing model	//	Lack of experience to implement these practices (cultural barrier).	//
Pay-per-use model	Sharing the costs between users makes it more sustainable. Behavioral incentives to optimize water.	//	//
Public-Private Partnership (PPP) model	Promotes meaningful collaboration between public and private sectors. High efficiency and know-how.	Bureaucratic burden and limited time to implement. Difference of interests between stakeholders, and difficulties to align such interests.	//
Resource recovery model	Increased attractiveness to the public and authorities. Good for industrial and agricultural applications, and importance of know-how to optimize and recover the resources (sustainable in the crop field).	Very focused on the environmental aspects, but not on the financial side. Not a widespread model, which poses an initial challenge to be established in the market and obtain clients.	//
Consulting and engineering services model	It has sensors and information systems that can provide information.	//	It is more focused on IT services rather than on the technology itself.
Community-based cooperative model	Beneficial for small scale coastal communities. More engagement of stakeholders than in a centralized system. Can enable a small pilot opportunity to be tested and potentially scaled up in the future.	//	//

Table 13. DS3 – CA solution 2 Business model analysis

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In accordance with the results displayed in the previous tables, the DS3 partners discussed the applicability of each of these business models to the solution. Table 12 includes the theoretical description of the set of business models proposed, while Table 13 consists of the analysis made by the partners in terms of advantages, disadvantages and other comments.

The Water Reuse Masterplan & Business Plan offers a set of systems dealing with different water treatments, and diverse business models were proposed for each one. Such different solutions included: rainwater harvesting, recycling gray water, recharging aquifers, reducing impermeable surfaces and desalination. During the workshop, the partners considered analyzing the Masterplan as a whole and offering an overview of the applicability of the business models from a more general perspective. Water reuse is the main domain of intervention of this solution, and these previously mentioned systems are to be implemented depending on the characteristics of the regions. For instance, desalination was considered to be for islands rather than mainland and is expected to be studied and optimized in the future. Thus, the considerations in terms of the business models were analyzed in a more general approach.

Starting with the subscription-based model, it was commented that implementing it would be beneficial for municipalities facing issues related to water scarcity in the case that a water company were to invest in strategic series of units.

The leasing model, on the other hand, was not as highly considered. As explained by the partners, it is not widely used in Greece, which supposes a cultural barrier. For this reason, then, the lack of experience when implementing this model is a significant disadvantage to take into account.

Moving on to the pay-per-use model, one of its advantages was that it would allow us to share the costs between users, making it more sustainable. Additionally, the respondents added that such a model could potentially incentivize users' behavior in order to optimize their water usage.

Amongst all the possibilities of business models, the PPP model was the one considered to be most applicable. The partners mentioned that it fostered more collaboration between the public and private sector, and that it could benefit from the combination of the private sector in terms of high efficiency and know-how and from the public sector in terms of authority. However, it posed disadvantages regarding the bureaucratic burden and the difficulties in aligning the diversified interests of the stakeholders.

On another note, the resource recovery model was said to have recently become more popular, leading it to be more attractive for the public and authorities. In addition, the partners commented that it is a good model for industrial and agricultural applications. However, some of its barriers included its main focus on environmental aspects rather than in finance, and the fact that it is still not very widespread. This poses a significant challenge when becoming established in the market.

As for the consulting and engineering serviced model, it was not considered to be very applicable to the solution given that it may be more focused on IT services rather than on the technology itself.

Lastly, the community-based cooperative model poses some advantages highlighted by the partners, one of them being that it can lead to a higher engagement of stakeholders as opposed to a more centralized system. Additionally, it was mentioned that this kind of model is mostly beneficial for small scale coastal communities.

5.2.3.5 Barriers to access and leverage finance for solutions

Starting with the financial barriers, those with the highest relevance were regarding the high initial capital requirements implied by the solution. It was mentioned that not only the capital expenditure is significant,

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but also the operating expenditure, which includes all the costs that come with operating the technology. Additionally, the insufficiency of financial instruments constitutes a highly relevant barrier. At a more medium level of relevance, the partners considered that there is difficult access to capital markets, in order to receive financing, and a lack of incentives when searching for finance given all the other barriers. In terms of the incentives, they also depend on the motivation and competence of the end-user.

In the regulatory barriers, the lengthy and complex approval systems were allocated in high relevance. That is, as explained by the partners, the approval procedures are typically very long and time-consuming to overcome. In addition to this, the inconsistency and unclearness of policies constitutes another barrier. In this sense, the respondents added that there are several challenges coming from multi-level governance, as well as overlapping responsibilities. Then, with medium relevance, the difficulties of obtaining support and feedback from other stakeholders and national policies were included.

As for the market barriers, the most relevant ones were in terms of the existence of niche markets. In this sense, the partners mentioned that the markets are small, but the intent is to scale up to larger areas. On the other hand, the information and awareness gap were allocated at medium relevance, given that, currently, there is a lack of general awareness on how to approach water-energy solutions and a lack of knowledge regarding what is the most adequate business plan. Lastly, with lowest relevance, it was mentioned that there is some established competition as several technologies have already been tested and optimized, but it is not very significant.

Moving on to technological barriers, none were highly relevant. However, at the medium level, the compatibility barrier was included. In this sense, it was added that it is important to communicate the knowledge of the solution to other stakeholders and end-users in order to enable its continuity and transferability in the future. Additionally, another barrier is regarding the lack of training of the operators, which then leads to more problems when setting up the system, and the high R&D expenses. The risk with regards to technology and uncertainty was of low relevance for this solution.

Lastly, as for the institutional barriers, the institutional inertia when adopting new practices, innovations and business models was mentioned, as well as the coordination and collaboration difficulties. These difficulties are since public institutions often collaborate with many layers of authorities and actors. At the medium level of relevance, the limited capacity for adopting and preparing such innovative projects was included.

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6 Conclusions

In the face of escalating climate risks, both the industry and finance sectors play crucial roles in advancing climate adaptation (CA) solutions. The work carried out in T6.2 has been instrumental in developing an initial framework that addresses the dynamics, policies, business models, barriers, and facilitators within the CA landscape. D6.6, in particular, emphasizes the vital role of private-sector decision-makers in driving the transition towards CA in industry. It also delves into emerging CA business models, financing instruments, key stakeholders, and EU initiatives that are catalyzing this shift. Thus, it helps to IMPETUS partners to anticipate potential business opportunities regarding the prioritized CA solutions.

The methodological framework employed in WP6 has proven effective in generating outcomes across the various task dimensions. Specifically, T6.1 has developed guidelines for decision-makers in public administration, T6.2 has formulated guidelines for decision-makers in the private sector, and T6.3 has identified the project's key exploitable results and designed exploitation plans. Additionally, the theoretical foundations of key IMPETUS concepts, such as the Resilience Knowledge Boosters (RKBs) and the platform, have been conceptualized.

Subsection 7.1 outlines key conclusions and offers initial guidelines to help decision-makers leverage business opportunities and develop effective adaptation strategies. These guidelines aim to close the gap between current practices and the innovative approaches required to tackle climate challenges.

Lastly, the next steps for T6.2 will be discussed in the final deliverable, D6.7.

6.1 General principles for decision-makers in business and finance

1. Objective: Investment in disaster risk management: Reassessment and updating of hazard mapping.

Action: Develop state and national governments capacities through the allocation of budgets and resources in managing disaster risks towards the minimization of likely risks resulting from natural calamities. Provide periodic updates of hazard maps with current climate data and risks and integrate them into regional and urban planning processes.

Outcome: It will be disaster resilience, translating into reduced losses; this will make infrastructure and communities safe, ensuring development with lesser losses and more benefits socially, environmentally, and economically by proper planning.

2. Objective: Increase Public-Private Partnerships in climate adaptation.

Action: Public authorities must further back and cooperate with the private sector to enable innovative projects, such as, for example, the Water Reuse Masterplan prepared within the IMPETUS project. Competences and resources should be combined in both sectors, deploying cost-effective climate adaptation solutions.

Outcome: Innovation in finding climate adaptation solutions and resource efficiency are the results; thus, effective and scalable climate resilience solutions. More cooperation means more sharing of knowledge and resources for mutual benefits.

3. Objective: Collaborate with insurance companies to retain risk-based pricing models.

Action: Engage the insurers in developing and iteratively improving pricing models representative of current climate hazard risks. In such a way, current levels of risk will be appropriately reflected in the premium, and this shall allow appropriate and efficient risk management strategies at the level of projects, like the Emergency Management Subscription Model.

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Outcome: The result is the better alignment of insurance premiums with real-world risk through proactive climate adaptation and risk reduction. Financial stability in projects that entail climate adaptation will be guaranteed through the continuous updating of the risk models to the current climate variability.

4. Objective: Examine mechanisms for public financing to support climate adaptation projects.

Action: Access all available public financing through grants, coupons, and subsidies to finance climate adaptation. Utilize public financing combined with private capital in cases where practical for the improved financial sustainability. This results in an increased investor pool for projects like Pay-Per-Use and Leasing Models.

Outcome: Qualitatively and quantitatively increased availability of Blended Finance sources in developing and scaling Climate Adaptation Projects. Blended Finance pools public and private financing with a view to securing more ambitious, fiscally sound, and impactful projects.

5. Objective: Engage in academia for evidence-based climate change adaptation measures.

Action: Contribute to accessing the latest research related to climate change and impacts from higher education institutions. Use academic perspectives in contributing to the preparation and development of strategies for climate adaptation, especially in the field of technological development and environmental monitoring services, such as Environmental Monitoring as a Service.

Outcome*:* Evidence-based research will inform appropriate decisions that will result in effective climate change adaptation strategies. Academic expertise also aids in integrating innovativeness in many technologies that will reduce the effects of the climate.

6. Objective: Investing in enabling solutions for Climate Adaptation (CA).

Action: Invest in technologies and solutions that enhance the capability for assessing, predicting, and monitoring climate risks. Develop and deploy risk assessment and predictive analytics tools, on advanced water management system grounds, able to produce for organizations the key data to be used for climate adaptation planning.

Outcome: Increased capability of the organization to anticipate and implement measures that reduce the risks created by changes in climate, thereby enhancing its resilience. Improved access to technology ensures an effective informed approach to adjustment, reduces vulnerability, and increases long-term sustainability.

7. Objective: Internal awareness creating on the impacts of climate change and integrating metrics of climate risk into impact assessments.

Action: Metrics for climate risk shall be included in all strategic planning and impact assessment of a company considering the due understanding on social, environmental, and economic dimensions. The integration is so crucial, especially for newly proposed schemes on sustainable financing-like EU Taxonomy and ESG criteria.

Outcome: Enhance internal decision-making with respect to climate risk, with full compliance with evolving regulatory frameworks. The organizations make their investments more informed in regard to climate-risk metrics, thereby enhancing their resilience against adversities arising from climate factors.

8. Objective: To study climate adaptation through innovative financing instruments.

Action: explore and adopt new financial instruments and mechanisms—marketable green bonds, catastrophe bonds, or insurance-linked securities—that could be used to unlock capital for investment in climate adaptation projects. Use flexible financing structures allowing the involvement of a broad range of investors and other stakeholders.

Outcome: Improved risk-return profiles of investment in climate adaptation, hence far more attractive for investors and, at last, mobilizing the capital and increasing financial support for adaptation projects.

9. Objective: This mobilizes capital from different sources using blended finance approaches.

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Action: Utilize Blended Finance Blended finance mixes financial and nonfinancial returns from a mix of public, private, and philanthropic sources of capital. The model for blended finance de-risks investments made in climate adaptation projects, thereby improving the risk-return profile.
Outcome: More significant investment in climate adaptation for more secure and diversified funding. Blended finance approaches have the impact of decreasing financial risks and, thus, supporting private sector involvement in project implementation.

6.1.1 Guidelines for decision-makers in VC and business angels

1. Objective: Integration of climate-related risk in the investment decision-making process.
***Action*:** Due diligence should include climate risk assessments for all potential investment opportunities. Let the start-ups come prepared on how such a climate risk would affect their businesses, financial projections, and growth strategies. Let investors be allowed to provide a framework within which the assessment of climate risks, and associated adaptation strategies likely to affect start-up investments.
***Outcome*:** Climate-informed investment decisions are made, giving investors more resiliency and therefore more sustainable business models to startups. Investors can be more strategic in their decisions and choices to help them reduce long-term risks, while the startups are in a better position to address the implications of climate change within their operations and revenue models.

2. Objective: Blended finance models implemented and accepted among the startups.
Action: Predictably, the blended finance models combine public and private funding sources in a way that minimizes risk to investors. Train venture capital firms and business angels to structure investment deals using blended finance mechanisms, such as grants, subsidies, and equity investments that can be used to de-risk projects while attracting more funds.
***Outcome*:** More investment flow towards start-ups in the Climate Adaptation and Resilience sector, with a reduced financial risk for the investor. The blending of Public-Private funds allows for significant investments in innovative climate solutions while enabling sustainable growth for the so-called "climate-smart" start-ups.

3. Objective: Invest in scalable solutions with proven impact in managing climate risks.
***Action*:** With some priority investment, it will only be in such start-ups that have the potential to provide scalable solutions with impacts already proven, whether in managing or mitigating climate risks. Their technologies and business models should allow for wide diffusion—be it renewable energy systems, water management technologies, or even climate data analytics platforms.
***Outcome*:** Investment in scaling growth and expansion will flow to those high-potential startups focused on scalable solutions. The contribution toward managing climate risks at a scale significantly increases. The investors get such benefits because they support startups that have track-tested deliverables, hence increasing their potential for success and positive returns.

4. Objective: Contribute to innovative and climate-smart business model growth.
Action: Development of, and continuous improvement in, business models in tune with evolving climate policy, regulations, and market demand. Support the business model innovation with knowledge and know-how, market intelligence, and linkages with regulators. Allow integration of climate adaptation and resilience strategies in core business operations.
Outcome: This advantageously positions the startups for winner-takes-all success in growing markets, increasingly constrained by both policy and reasons of sustainability. Climate-smart business models empower a startup to tap new markets and embrace customers, especially those who are eco- and socially conscious. Investors benefit through investments in companies that are ready for future regulation changes and possible market restructurings.

5. Objective: Enable capacity building on the CC policies and market demands.

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Action: Activities Mentorship, training, and related resource provision to augment capacity in start-ups toward meeting climate change policy and market needs. Knowledge dissemination—supporting initiatives and endeavors that enable start-ups to comprehend climate risks and reveal opportunities available through climate adaptation. Advise on regulatory action compliance, risk management, and market positioning in the face of changing climate dynamics.
Outcome: For the understanding of climate change-related risks and market opportunity links; for climate adaptation by start-ups and knowledge on making informed, effective decisions to convert them into proper strategies; and finally, resilience. It will also encourage investors to make a decision based on investment with a better-equipped startup concern for long-term growth in challenges related to climate adaptation.

6.2 Next steps

- Workshops to the pending demonstration sites:

The format developed in DS2 and DS3, with participation in workshops alongside DS1, DS4, DS5, DS6, and DS7, will be maintained. Those workshops will have as key messages the most recent and relevant EU initiatives related to the European Green Deal, Horizon Europe, REPowerEU, and the Just Transition Mechanism introduced in Section 4 of this document. The outcome of these workshops will be used to further elaborate on Deliverable D6.7 how financial tools arising from these schemes best can be deployed by the private sector. These workshops will study innovative business model opportunities within a green transition and climate resilience frame. Moreover, general categories will be listed regarding initiatives/programmes and especially business models adapting to IMPETUS products and outcomes.

- Incorporating EU financial initiatives:

Building on the identification of key European Union initiatives presented in Section 4 below, we will revisit the financial strategies described in Deliverable D6.5 to add value with respect to the role of key EU programs such as the LIFE Programme, European Green Bonds, and the CEF-every one of which offers vital funding for extremely large-scale climate adaptation projects of value to Venture Capitalists, investors, and companies seeking either to supply climate adaptation themselves or benefit from other interventions. Particular attention should be given to public-private partnership models and blended finance solutions that could decrease the risk for private investors, hence leading to scaling up CA solutions.

- Discussion with external experts:

We shall validate the challenges depicted in this document by interviewing independent experts, venture capital and angel investors, and representatives of EU programmes. Recommendations from such consultations shall be used to find new ways in which EU funding schemes can help provide timely solutions to bridge gaps in private finance investment and enhance scalability relating to disruptive business models. Results will be included in Deliverable D6.7, a section updated in D6.6.
Integration of Insights Gained from Previous Workshops.

The results coming out of the DS2 and DS3 workshops, in conjunction with inputs from revised EU financial initiatives, will be further validated along with our iterative methodology with the DS partners to confirm the strength of the guidelines. Further steps will involve updated financing strategies prepared with the new EU initiatives on the European Climate Pact and the Green Deal Industrial Plan in line with priorities set by national and local governments.

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