



OUTPUT 05: GUIDANCE NOTE ON IMPLEMENTING LOCAL ADAPTATION STRATEGIES IN THE COASTAL BUILT ENVIRONMENT.



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1. Introduction

Following the IPCC 5th Assessment Report, climate change refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. This change may result from either natural internal processes or external forcings, such as solar cycle modulations, volcanic eruptions and persistent anthropogenic changes in atmospheric composition or land use (IPCC, 2014)¹.

Climate change has many consequences on natural and human systems, including, among others, sea level rise, flooding, erosion, intense droughts, water shortages, severe fires, melting of the poles, more intense and frequent storms and declining biodiversity.

Coastal areas are not exempt from these climate change related impacts, probably the most pressing being those related to sea level rise, flooding and erosion. In the specific context of the coastal built environment, these impacts become a direct threat to its human, physical, economic, social, environmental and governance components.

In addition to mitigation-oriented strategies to reduce greenhouse gas emissions, adaptation to climate change is necessary to reduce the negative effects that climate change may cause and thus to protect human and natural systems. Adaptation is considered in this study according to the IPCC definition as the process of adjustment to actual or expected climate and its effects, to moderate harm or exploit beneficial opportunities (IPCC, 2014).

Coastal zones are complex, both from the point of view of natural and human systems and the interaction between them. This, together with the uncertainties associated with climate change-related studies, makes the planning and implementation of climate change adaptation strategies a major challenge for managers, administrations and professionals.

This guide is intended to be a useful tool to support the process of implementing climate change adaptation measures in coastal built environments. To that end, this guidance note presents general top tips to implement coastal adaptation strategies, instruments available to support local adaptation to climate change (regulatory, financial, strategies, datasets, guidelines etc.), and some examples of actions undertaken by communities and government agencies that may be useful to inspire others to consider the potential in their community and the possibility of implementing successful case studies elsewhere where needed. Accordingly, this document is intended to serve as a guide for managers and professionals of coastal built environments to support them in identifying suitable and appropriate adaptation measures that can be applied in their site-specific context.

The guide has been developed in the framework of the Erasmus + project *BEACON* (Built Environment leArning for Climate AdaptatiON) funded by the European Union (EU). The partners of this project are universities from Spain, Sri Lanka, Sweden and the United Kingdom, Malta.

¹ At the time of finalizing this document (March, 2023), IPCC Working Groups contribution to the IPCC AR6 are finalized; however, it is still subject to revisions, including those of its glossary. Therefore, here are cited those that correspond to the approved IPCC AR5 (2014).

2. Methodology

This guidance note has been prepared following both a research analysis and a participatory validation process involving key stakeholders from all participating countries.

First, an exhaustive bibliographic and documentary review was carried out to identify both case studies in the built environment of coastal areas, and existing instruments (regulatory, financial, strategies, datasets, guidelines etc.) to support the implementation of climate change adaptation strategies at the national level.

This work inspired the elaboration of a comprehensive list of general recommendations for the development and implementation of climate change adaptation measures, here called: “Top Tips”, to guide institutions and managers on the essential aspects to be considered when planning and implementing adaptation measures in coastal urban areas.

Based on the aforementioned review, a preliminary list of available instruments to support climate change adaptation in each country was drawn up. Various types of instruments were identified, including regulatory instruments, national strategies and plans, financial instruments, available databases, software, hardware and scientific facilities. This list can serve as a reference of the type of instruments needed for the implementation of climate change adaptation measures.

A catalogue of case studies was also developed, including best practices and successful experiences in implementing local climate change adaptation measures in the coastal built environment. The catalogue includes case studies developed in Spain, Sri Lanka, Sweden, United Kingdom and Malta. In addition to these specific countries, from a more regional perspective, the catalogue also includes cases from other European countries.

After the bibliographic and documentary review, the participatory process aimed to (i) validate the preliminary research analysis on Top Tips and available instruments, and (ii) analyse the adequacy of different types of adaptation options in urban coastal zones, following the classification of the Intergovernmental Panel on Climate Change (IPCC, 2014), presented in

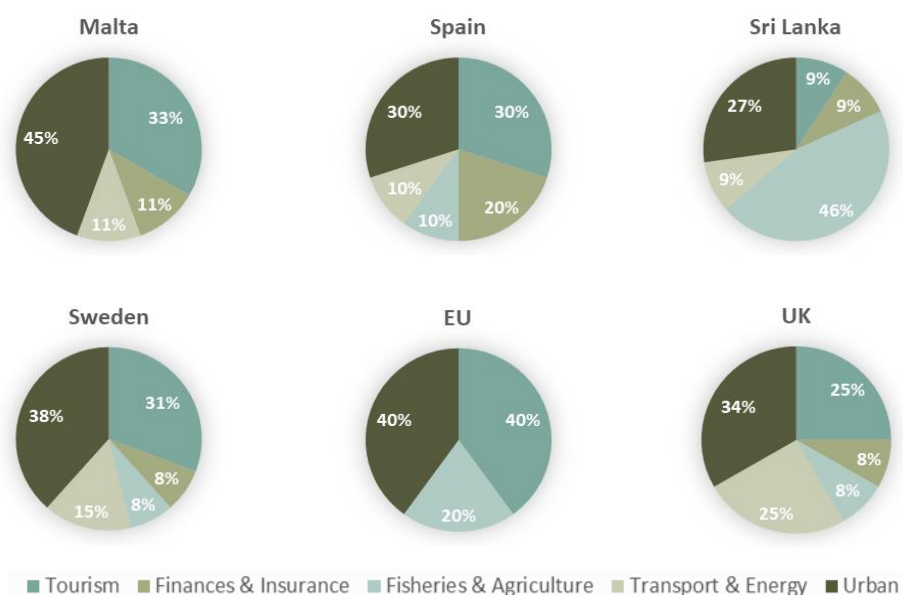


Figure 3. Percentage of case studies that address each built environment sector by country.

1. To this end, interviewed stakeholders assessed all categories considering the existence of regulatory framework, social acceptance for the implementation of a given category of adaptation options and other factors that may enable or hinder their implementation, according to the following scores:

- Very adequate: legal and institutional framework, as well as financial and technical resources, are in place; social acceptance, etc.
- Moderately adequate: the local framework allows implementation, but some aspects need to be improved.
- Unsuitable: not possible to implement because the country is not exposed to the specific climatic hazard, there is no regulatory framework, social acceptance or any other reason that hampers its implementation.

The participatory process was conducted through semi-structured interviews that were conducted both face-to-face and on-line video calls. The total number of interviewed were 92 grouped in a different type of stakeholders per country as shown in Figure 1.

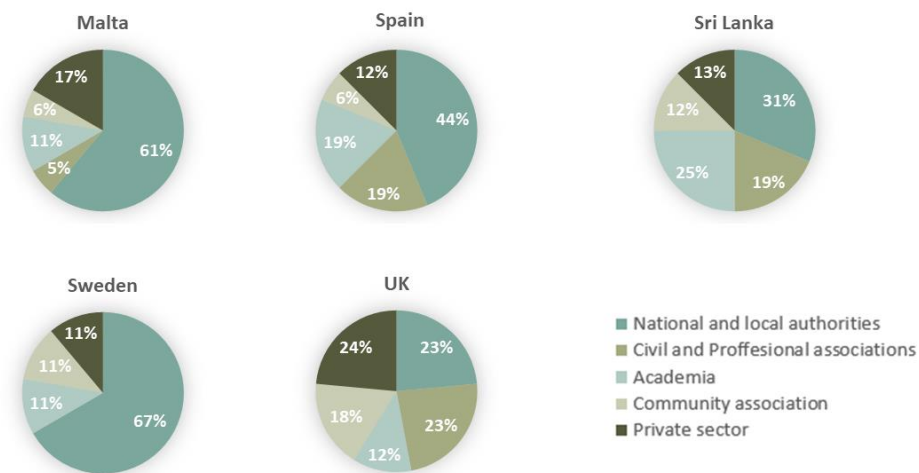


Figure 1. Type of stakeholders interviewed per country (in %)

3. Top Tips

The Top Tips are general recommendations that should be considered by managers and professionals when developing climate change adaptation measures.

1. Quantify current and future climate related risks in land use planning and urban development

It is necessary to develop an in-depth diagnosis of climate-related risks, based on scientific data, as well as their continuous monitoring. This requires the identification of natural hazards in the target study area and their quantification, preferably based on numerical models, the assessment of the vulnerability of the different dimensions of the coastal built environment (social, economic, infrastructure, environment), and the analysis and mapping of the resulting risk in current and future scenarios, also considering cost-benefit analysis and the planning of post-disaster activities. To this end, it is necessary to establish the most appropriate climate change scenario(s) and horizon year to be analysed, in line with other plans and strategies for the target study area. The risk results provide the baseline information for designing site-specific climate change adaptation measures and developing a climate change adaptation plan. Regular monitoring and updating of the risks analysed provide relevant information for adaptive management.

2. Design comprehensive climate change adaptation plans

Based on a deep understanding of climate-related risks, it is recommended to elaborate comprehensive climate change adaptation plans to define and select climate change adaptation measures (structural/physical, social and institutional) and a roadmap for their implementation. The plan should also define monitoring and evaluation tools to assess the implementation process and the effect of the measures on the coastal built environment.

3. Apply an adaptive management approach

Promote flexible and dynamic adaptive management to reduce uncertainty in decision-making through system monitoring and regularly update climate change adaptation plans. Use monitoring and last-generation data and methodologies to update the assessment of climate related risks and innovative techniques to design climate change adaptation measures.

4. Consider a holistic approach to address coastal complexities

Apply a holistic approach preferably following Integrated Coastal Zone Management (ICZM) principles for coastal planning, which are fully integrated with climate change adaptation. In this regard, it is necessary to consider the interaction between the components of the coastal built environment (physical, economic, social, environmental and governance), the different sectors (tourism, financial, fishing, agriculture, transport, and navigation, urban, etc.), and the different levels of administration (neighbourhood, local, national, etc.). All these coastal aspects must be addressed in a balanced manner to achieve sustainable development.

5. Capitalise on previous efforts and initiatives

Analyse previous initiatives developed in the target study area to build on existing climate change adaptation activities. Incorporate climate change adaptation approaches into those initiatives that can be improved. Additionally, explore synergies between climate change adaptation and mitigation measures.

6. Work with local planning authorities and key agencies

Involve local authorities and create coordination mechanisms for local climate change adaptation. This will contribute to identifying previous efforts and initiatives, identifying potential

opportunities from climate change, avoiding conflicts and overlapping competencies, and designing cross-sectoral climate change adaptation measures that benefit components and sectors of the coastal built environment.

7. Involve local community

Promote the participation of indigenous knowledge, local community populations and other local stakeholders, such as public entities, civil organizations, local professional organizations, research entities and the private sector, in the decision-making process on climate change adaptation.

8. Explore available funding for climate change adaptation

Contact local and national climate change adaptation offices to explore funding opportunities available in the target study area. In addition, search for international and regional funding for climate change adaptation, such as the European Commission programs, the Green Climate Fund, United Nations and development banks funds, among others. Research centres, universities and private innovation companies can support you in applying for international and regional funding.

9. Collaborate across borders

Make sure to collaborate on adaptation measures across borders, both geographical and administrative. To work effectively, it is necessary to strengthen collaboration with all stakeholders related/affected by the climate change adaptation measures that are planned to be implemented.

10. Prioritize Nature-based solutions

Nature-based solutions (NbS) should be explored actively and make necessary systemic changes to promote them. Many NbS solutions have multipurpose functions (co-benefits) and not only contribute to adaptation, but also to a more resilient ecosystem, promote greater biodiversity, sustainable development, and contribute to mitigation objectives.

4. Instruments available to support local adaptation to climate change

This section presents the available instruments to support local adaptation to climate change at country level, including regulatory instruments, national strategies and plans, financial instruments, available databases, software/hardware/scientific facilities and others. This list can serve as a reference of the type of instruments needed for the implementation of climate change adaptation measures. Although this list is presented by country, it is advisable to check the available instruments in other countries, especially those related to databases, software and scientific facilities, as they may be helpful.

4.1. Spain

4.1.1. Regulatory Instruments

- **Law 7/2021, of May 20, on Climate Change and Energy Transition** (Click [here](#))

This law includes adaptation policies and the need to define a system of indicators to monitor and evaluate the adaptation to climate change, which facilitates monitoring and evaluation.

- **Law 21/2013, of 9 December, on Environmental Assessment** (Click [here](#))

This law considers mitigation and adaptation to climate change in the strategic environmental assessment of plans and programmes., including those related to land use and urban planning.

- **Royal Legislative Decree 7/2015, of October 30, approves the consolidated text of the Land and Urban Rehabilitation Law.** (Click [here](#))

This instrument regulates the conditions for land use development and establishes criteria for land use, including the prevention of climate change-related risks.

- **Law 22/1988, of July 28, on Coasts** (Click [here](#)) **and its update Law 2/2013, of 29 May, protection and sustainable use of the coast** (Click [here](#))

This law regulates the determination, protection, use and policy of the maritime-terrestrial public domain and especially of the maritime shore. Law 2/2013 requires the development of a strategy for the adaptation of the coast to the effects of climate change.

- **Royal Decree 903/2010, of 9 July, on the Assessment and Management of Flood Risks. Transposed from Directive 2007/60/EC of the European Commission.** (Click [here](#))

It aims to generate new tools at the EU level to reduce the potential consequences of floods through risk management, supported by flood hazard and risk mapping.

- **Royal Decree 314/2006, of March 17, 2006, on Technical Code of Building Construction** (Click [here](#)) **and its update Royal Decree 450/2022** (Click [here](#))

This law includes the main regulations governing the construction of buildings in Spain, including the promotion of the adaptation of buildings to the use of renewable energies and electric vehicles.

- **Regional and municipal regulation**

Consult regional and local regulation, especially in the areas of urban planning and climate change adaptation.

4.1.2. Financial Instruments

- **European funding such as LIFE Programme** (Click [here](#)).

- Funds managed through the Biodiversity Foundation (Click [here](#)).
- Funds managed through the Institute for Energy Diversification and Savings (Click [here](#)).
- Funds managed through the Center for the Development of Industrial Technology (Click [here](#)).
- Funds managed through the Center for Energy, Environmental and Technological Research (Click [here](#)).
- Program to support actions to improve energy efficiency –Ministry of Transportation, Mobility and urban Agenda (MITMA) (Click [here](#)).
- Transportation and mobility grants – MITMA (Click [here](#)).
- Common Agricultural Policy – MITMA (Click [here](#)).

4.1.3. National Strategies and Plans

- **National Climate Change Adaptation Plan (PNACC) 2021-2030** (Click [here](#))

The PNACC is a reference framework for the co-ordination of the public administrations in the activities of impact assessment, vulnerability studies and adaptation to climate change in Spain.

- **Strategy for Adaptation to Climate Change on the Spanish Coast** (Click [here](#))

Launched in 2016, this strategy calls for the integration of urban planning and climate change projections. This strategy is complemented by regional strategies developed by the national coastal agency to protect the coast considering the effects of climate change and derived risks in the coastal areas,. The strategy is based on the results of the study entitled “Climate change on the Spanish coast” (MAPAMA, 2014).

- **Environmental Promotion Plans for Climate Change Adaptation (PIMA)** (Click [here](#))

The so-called PIMA Adapta Plans is an operational tool in place since 2015 to support the achievement of the objectives of the National Plan for Adaptation to Climate Change at regional and local level. PIMA Adapta Plans have become an important instrument to promote and support adaptation to climate change, contributing to several aspects such as knowledge generation, governance, sectoral integration, actions on the ground, monitoring, etc., and promoting action at all levels (administrative, academic, private and NGO).

- **National Strategy for Green Infrastructure, Ecological Connectivity and Restoration** (Click [here](#))

Strategic planning document that regulates the implementation and development of green infrastructure in Spain, establishing a harmonized administrative and technical framework for the entire Spanish territory, including maritime waters under national sovereignty or jurisdiction.

- **Spanish Climate Change and Clean Energy Strategy** (Click [here](#))

This strategy is part of the Spanish Sustainable Development Strategy, elaborated in 2007. This strategy addresses different measures that contribute to sustainable development in the field of climate change and clean energy, which is highly related to urban development models.

- **Spanish Urban Agenda** (Click [here](#))

The Spanish Urban Agenda (Ministerio de Fomento, 2018) identify climate impacts that currently affect Spanish cities, and points out that the inclusion of climate and risk forecasts into territorial and urban planning is essential to prevent climate related risks, increase the resilience of urban environments and increase the capacity to anticipate and reduce uncertainties.

- **Green infrastructure and urban stewardship: contributing to climate change adaptation in cities** (Click [here](#))

The Biodiversity Foundation has a line of action of renaturalization and resilience of urban environments, responding to the need to integrate the conservation of biodiversity in the planning and management of the whole territory.

- **National Conservation Strategies** (Click [here](#))

Conservation strategies include the management of endangered species, control of major threats, conservation of endangered flora, plant preservation and conservation of pollinators.

- **Instrument of Ratification of the European Landscape Convention**, done at Florence on 20 October 2000. (Click [here](#))

The general purpose of the Convention is to encourage public authorities to adopt policies and measures at local, regional, national and international levels to protect, plan and manage European landscapes with a view to conserving and improving their quality and to lead the public, institutions and local and regional authorities to recognize the value and importance of the landscape and to take part in public decisions relating to it.

- **Regional strategies:**

Consult regional and local strategies for climate change adaptation and coastal protection.

4.1.4. Available Databases and Viewers

- **Climate Change Adaptation platform: AdapteCCa** (Click [here](#))

AdapteCCa is a collaborative platform for consultation and exchange of information on impacts, vulnerability and adaptation to climate change.

- **Environment Database – Ministry of Ecological Transition (MITECO)** (Click [here](#))

Access to alphanumeric, cartographic, documentary and multimedia information available on the different components of the Spanish Inventory of Natural Heritage and Biodiversity.

- **Met-ocean database: IHData** (Click [here](#))

IHData provides accurate wind, wave and sea level weather statistics for any European country and wave conditions for any region of the world.

- **Spatial Data Infrastructure - Ministry of Ecological Transition (MITECO)** (Click [here](#))

Access to water, climate change, coast and marine, biodiversity and forest, and environmental quality databases and GeoViewer.

- **Database of the National Port Authority** (Click [here](#))

This database provides met-ocean variables and predictions along the Spanish coast.

- **Database of the Spanish National Research Council** (Click [here](#))

A multidisciplinary bibliographic resource that compiles and disseminates mostly research articles

- **National Flood Zone Mapping System** (Click [here](#))

Access to a geo-viewer intended as a support tool for land use planning and risk management, including river and coastal flooding under climate change scenarios. The general information is available [here](#).

- **Climate Change on the Spanish Coast - C3E Viewer** (Click [here](#))

Access to the C3E viewer, which integrates the results of the "Climate Change on the Spanish Coast" project developed in the period 2009-2012 for the Spanish Office of Climate Change. This is part of the Strategy for Adaptation to Climate Change on the Spanish Coast. It includes data related to met-ocean variables (sea level, swell and sea surface temperature) for current and future conditions under IPCC AR5 climate change scenarios RCP4.5 and RCP8.5.

4.1.5. Available Guidelines

- **Guide for the elaboration of local plans for adaptation to climate change – Ministry of Ecological Transition (MITECO)** (Click [here](#))

This guide is an important contribution to progress in the integration of adaptation into planning and management and the increased resilience of systems, sectors, resources and geographic surroundings vulnerable to climate change in Spain.

- **Guidelines and directives for environmental assessment** (Click [here](#))

Guidelines for environmental impact studies.

- **Vulnerability of Spanish Ports to Climate Change** (Click [here](#))

This report focuses on the development, validation and application of regional oceanic models for climate applications, and the characterisation of the climatic evolution of marine parameters of importance for port activity.

- **Guidance for the development of adaptation plans to climate change in schools** (Click [here](#))

This guide aims to provide tools and resources for schools that want to start a school-based climate change adaptation project at school.

- **Citizen Science for Monitoring Climate Change in Ecosystems** (Click [here](#))

This document presents a vision and recommendations to all those individuals and groups interested in the design and implementation of local citizen science projects for climate change adaptation.

4.1.6. Software/Hardware/Scientific Facilities

Software

- **GIS software (ArcGIS, QGIS, etc.).**

GIS software is a basic tool for analysing and mapping different variables related to CCA.

- **Coastal Modelling System (SMC)** (Click [here](#))

Developed by IHCantabria, this system includes databases, methodologies and numerical models, which allows the study of coastal processes at different temporal and spatial scales, their effects on the coast due to natural events (storms, climate change) or human interventions and the design of coastal works and infrastructures for climate change adaptation.

- **IHFOAM** (Click [here](#))

Developed by IHCantabria, this three-dimensional numerical modelling software is designed to simulate coastal, offshore and hydraulic engineering processes, specially designed for

consultants/engineers. Its core is based on OpenFOAM®, a very advanced multiphysics model, widely used in the industry. What makes IHFOAM 2.0 different is a wide collection of boundary conditions which handle wave generation and active absorption at the boundaries.

Scientific facilities

- **Balearic Islands coastal observation system (SOCIB)** (Click [here](#))

SOCIB is a Coastal Ocean Observing and Forecasting System located in the Balearic Islands. It is a multi-platform distributed and integrated system that provides streams of oceanographic data and modelling services to support operational oceanography in a European and international framework, therefore also contributing to the needs of marine and coastal research in a global change context.

- **IHCantabria** (Click [here](#))

IHCantabria's mission is to promote multidisciplinary and collaborative scientific excellence and knowledge transfer, to facilitate innovation that contributes to accelerating the achievement of the Sustainable Development Goals (SDGs), focused on the integrated management of socio-ecological water systems.

- **Cantabria Coastal and Ocean Basin (CCOB)** (Click [here](#))

CCOB's objective is to increase the efficiency and capacity of Spain's numerical, experimental and field facilities for coastal and port applications, offshore engineering and the multiple interactions between structures and ocean climate factors.

- **BC3 Basque Centre for Climate Change** (Click [here](#))

BC3 aims to strategically foster the co-production of knowledge relevant to decision-making by integrating environmental, socioeconomic, and ethical dimensions of climate change.

- **Spanish Institute of Oceanography (IEO)** (Click [here](#))

IEO is a public research organization, under the Ministry of Science, Innovation and Universities, dedicated to marine science research, especially to the scientific knowledge of the oceans, the sustainability of fishing resources and the marine environment.

- **Institute of Physics of Cantabria (IFCA)** (Click [here](#))

IFCA is an internationally recognized research centre oriented to understanding the components of nature, from elementary particles to the largest structures of the Universe. In terms of Meteorology and climate change, the research is focused both on theoretical and applied topics of the discipline, with special emphasis on regional climate variability, seasonal forecasting and climate change projections.

4.1.7. Others

The following agencies and organizations play an important role in climate change adaptation in Spain:

- **Spanish Office of Climate Change (OECC)** (Click [here](#))

Under the Ministry for Ecological Transition and the Demographic Challenge, OECC is responsible for developing policies related to climate change, as well as developing and implementing the PNACC in coordination with other agencies.

- **The Directorate General for the Coast and the Sea (DGCM)** (Click [here](#))

Under the Ministry for Ecological Transition and the Demographic Challenge (MITECO), DGCM is responsible for the management of the maritime-terrestrial public domain and the development of policies for the conservation of the coast and the sea. Its objective is both to guarantee the public and free use, and to protect the coastal and marine environment, considering the effects of climate change. It is also responsible for coordinating projects contributing to the protection and conservation of the coast and the sea, together with the regions, local authorities and public bodies. The DGCM has regional and province offices; in total, there are 13 Demarcations and 12 Provincial Services.

- **National Meteorological Agency (AEMET)** (Click [here](#)).

Within the framework of the PNACC, it coordinates efforts in the field of climate change scenario research.

- **Ministry of Transport, Mobility and Urban Agenda (MITMA)** (Click [here](#))

Collaborates in various action lines of the PNACC and the implementation of Agenda 2030.

- **Spanish Network of Cities for Climate** (Click [here](#))

This network brings together cities and towns committed to sustainable development and protection of climate change negative consequences. Its objective is to be a technical support instrument for Spanish local governments, (who have the responsibility of urban planning) providing them with tools to achieve a sustainable development model, while at the same time serving as a forum to exchange knowledge and experiences on the field. Some Spanish cities such as Barcelona, San Sebastián and Valencia, have carried out an analysis of impacts and vulnerability at the local scale and a growing number of municipalities have strategies or plans for climate change, which contain objectives and actions in terms of adaptation. However, regulations related to urban planning and capacities in local institutions need to be strengthened to address climate change adaptation challenges.

At the regional level, the Autonomous Communities have the competencies in urban and regional planning matters and establish strategic lines to be adopted by the municipalities. The Autonomous Communities have different internal structures, but most of them have specific departments focused on environmental issues that address climate change adaptation and planning and departments of land use planning.

At a local level, municipalities have the competencies in land use and urban planning and implement site-specific climate change adaptation and environmental conservation site-specific measures.

4.2. Sri Lanka

4.2.1. Regulatory Instruments

There is no Climate Act in Sri Lanka for the implementation of climate adaptation activities. According to the interviews with representatives of government organizations, it was evident that the Climate Act is presently in the drafting stages. Therefore, several other laws and acts related to the environment and other categories could be used for climate adaptation. The legal instruments are as follows:

- **The Soil Conservation Act No.25 of 1951** (Click [here](#))

This act which was amended in 1953, 1981, and 1996 is concerned with the control and mitigation of soil erosion, protection of soil from floods and designating, regulating and protecting erosion-prone areas. See the link below for the Act.

- **The National Environment Act, No. 47 of 1980** (Click [here](#))

This act which was amended in 1988, established the Central Environmental Authority. It has assisted in developing policies, setting standards and carrying out educational programs in relation to the environment and natural resources. See the link below for the Act.

- **The Coast Conservation Act, No. 57 of 1981** (Click [here](#))

This act was amended in 1988. The Coast Conservation Department was established as a result of this Act. The Department was made responsible for carrying out coast conservation programmes, developing a coastal zone management plan, and carrying out regulatory permit programmes. See the link below for the Act.

- **Urban Development Authority (Amendment) Act, No. 49 of 1987** (Click [here](#))

Section 8 of the Urban Development Authority Law has dictated regulations in building construction. This can be applied to climate adaptation in urban areas (Ministry of Justice - Sri Lanka, 2016).

- **Disaster Management Act, No. 13 of 2005** (Click [here](#))

This Act ensures the protection of the life of the community and environment from disasters and the maintenance and development of disaster-affected areas. Further, provisions under the section capture the impact on the environment. See the link below for the Act.

- **The Fauna and Flora Protection Ordinance (2009)** (Click [here](#))

The Forest Ordinance No.16 of 1907 (FO), amended in 1966, 1979, 1982 and 1988 advocates for the protection of forests from illegal operations and prescribes penalties for those who violate them. See the link below for the Act.

- **The Sri Lanka Land Reclamation and Development Corporation Act No. 52 of 1982** (Click [here](#))

The Act includes section 20C which sets out that the pollution of canals is an offence. It also lists the parameters of the said offence while capturing the legal ramifications for a person that violates and pollutes the said canals. See the below link for the Act.

- **The Flood Protection Ordinance Act No. 22 of 1955** (Click [here](#))

This act allows the Minister to declare any part of the country a flood zone. It includes provisions for developing a flood protection scheme, establishing a flood authority, developing flood management laws, and acquiring land for the ordinance.

- **Crown land ordinance Act (1947) (Chapter 454, Volume No. 12 Page No.789)** (Click [here](#))

This ordinance provided for the grant and disposition of crown lands in Sri Lanka, as well as the management and control of such lands and foreshore, as well as the regulation of the use of water from lakes and public streams, among other things.

4.2.2. Financial Instruments

The government of Sri Lanka faces difficulty in allocating Government of Sri Lanka (GoSL) funds for adaptation activities due to the financial crisis in the country. Therefore, it is important to have the below-mentioned financial instruments which provide funds as loans or grants. The following funding sources provide financial and technical assistance through different implementation bodies in the local context. The Climate Change Secretariat endorses all project proposals when obtaining funds through the following sources.

- **World Bank Funds (WB)** (Click [here](#))

The World Bank Group works in every major area of development. They provide a wide array of financial products and technical assistance. They have provided financial assistance for climate mitigation and adaptation projects in Sri Lanka (World Bank, 2022). The web link below reveals details of such projects.

- **Asian Development Bank (ADB)** (Click [here](#))

ADB offers a range of financing instruments, products, and modalities to provide for developing member countries. As a developing country, Sri Lanka received financial assistance for climate mitigation and adaptation (Guido, 2022). The web link contains details of such projects.

- **International Finance Cooperation (IFC)** (Click [here](#))

IFC advances economic development and improves the lives of people by encouraging the growth of the private sector in developing countries. This provides financial facilities for private sector organizations in Sri Lanka related to climate initiatives (International Finance Corporation, 2022). The web link below contains details of such projects.

- **Adaptation Fund (AF)** (Click [here](#))

The Adaptation Fund finances projects and programs that assist vulnerable communities in developing countries, helping them to adapt to climate change. Under this fund, several projects have been implemented in Sri Lanka (Adaptation Fund, 2022). The web link contains details of those projects.

- **World Food Project (WFP)** (Click [here](#))

The World Food Programme is the world's largest humanitarian organization. It provides financial assistance in climate action, climate adaptation, and climate and food security (UN World Food Programme, 2022). The web link below reveals details of projects in Sri Lanka.

- **United Nations Climate Technology Centre and Network (CTCN) funds** (Click [here](#))

The CTCN provides technological solutions, capacity building, and advice on policy, legal and regulatory frameworks tailored to the needs of individual countries in low-carbon and climate-

resilient development (Climate Technology Centre & Network, 2022). The web link below contains details of projects undertaken by CTCN Sri Lanka.

- **Global Environmental Facility (GEF)** (Click [here](#))

The Global Environment Facility is the world's largest funder for biodiversity protection, nature restoration, pollution reduction, and climate change response in developing countries (Global Environment Facility, 2022). The web link below contains details of projects under GEF Sri Lanka.

Under the GEF, there are two funds including Special Climate Change Fund (SCCF) and Least Developed Countries Fund (LDCF).

- **Green Climate Fund (GCF)** (Click [here](#))

The Green Climate Fund (GCF) is the world's largest climate fund which is mandated to support developing countries raise and realize their Nationally Determined Contributions (NDC), ambitions towards low-emissions, climate-resilient pathways (Green Climate Fund, 2019). The web link below contains details of projects under GCF Sri Lanka.

- **United States Agency for International Development (USAID)** (Click [here](#))

USAID provides financial assistance through climate adaptation projects and several other environmental and energy bases. The web link below reveals details of projects under USAID Sri Lanka (Solimar International, 2022).

4.2.3. National Strategies, Policies and Plans

The following national strategies, policies and plans can be applied in climate adaptation.

- **Sustainable Development Goals (SDGs) 2015-2030** (Click [here](#))

Goals 13 (Climate Action) and 11 (Sustainable Cities and Communities) of the SDGs are directly related to climate change adaptation. In addition, Goals 07, 14 and 15 could be used to tackle climate change (United Nations, 2022). See the below link for the SDGs.

- **Technology Needs Assessment and Technology Action Plans for Climate Change Adaptation (for food, health, and water sectors)** (2011-2016) (Click [here](#))

This aims to identify and assess environmentally sound technologies that have synergy between reducing the impact of climate change and the rate of GHG emissions in Sri Lanka within national development objectives (Vizzuality, 2022b).

- **National Forest Policy** (1995)

The main objective of this policy is related to forest management and conservation. Necessary management and conservation approaches have been defined in the 1995 National Forest Policy (Climate Change Secretariat, 2020).

- **Forestry Sector Master Plan (1995-2020)** (Click [here](#))

The FSMP was considered as a comprehensive long-term development framework for the optimal development of the forestry sector for the period 1995-2020 (ESCAMP, 2022).

- **National Air Quality Management Policy (2000)** (Click [here](#))

This National Policy focused on areas for Air Quality Management, prepared by National Experts. This is dependent upon the enforcement of the standards and laws that prevent air pollution (UN, 2022).

- **National Solid Waste Management Strategy (2000)** (Click [here](#))

The Solid Waste Management Strategy is important to reduce, where inappropriate dumping and other waste generation which can impact emission levels of the environment (Ministry of Environment, 2020).

- **Initial National Communication developed in 2000** (Click [here](#))

This comprises the national circumstances, greenhouse gas inventory, impacts and vulnerability, mitigation options and adaptation responses, policies and measures, education, training and awareness programmes, constraints and technological needs, recommended research studies and a portfolio of projects. See the link below for the document (Climate Change Secretariat, 2022).

- **National Environmental Policy (2004)** (Click [here](#))

The National Environmental Policy provides direction as to which steps will be taken to conserve and manage Sri Lanka's environment in all its aspects (Ministry of Environment-Sri Lanka, 2021). See the link below for more details.

- **National Wetlands Policy (2006)** (Click [here](#))

This policy ensures the protection of wetlands and conservation strategies which would help to carry out sustainable development in the country (Ministry of Environment-Sri Lanka, 2021). See the link below for more details.

- **National Land Use Policy (2007)** (Click [here](#))

The national land use policy will provide an appropriate policy framework for the protection, conservation and sustainable use of land resources in the country (Land Use Policy Planning Department, 2022). See the link below for more details.

- **National Climate Change Policy** (Click [here](#))

This policy addresses climate change issues locally while engaging in the global context. It aims at fostering adaptation and mitigation efforts within the framework of sustainable development (Ministry of Environment-Sri Lanka, 2021). See the link below for more details.

- **Nationally Appropriate Mitigation Action (NAMA) on Energy Generation and End-Use Sectors (2010)** (Click [here](#))

This report aims to support appropriate climate change mitigation action in energy generation and end-use sectors as part of the initiatives to achieve the GHG mitigation targets of Sri Lanka (Climate Change Secretariat, 2020).

- **Second National Communication (2011)** (Click [here](#))

This aimed to identify initiatives to reduce emissions from the sub-sector. Further to mitigating the above, technology transfer, research and systematic observations along with education, training and public awareness are facilitated (Climate change secretariat, 2016). See the link below for the second national communication.

- **National Climate Change Adaptation Strategy (NCCAS) (2011-2016)** (Click [here](#))

This document outlines a comprehensive National Climate Change Adaptation Strategy (NCCAS) which lays out a prioritized framework for action and investment for the 2011- 2016 period, aimed to create a climate change resilient future in Sri Lanka (Climate change secretariat, 2016a). See the link below for NCCAS.

- **NAMA on Transportation (Draft) (2015)** (Click [here](#))

NAMAs are voluntary, non-binding policy instruments that provide a framework for pursuing a country's socio-economic and development goals while contributing towards global greenhouse gas mitigation efforts. See the link below for NAMA (NAMA Design Document for Transport Sector of Sri Lanka DRAFT, 2015).

- **National Adaptation Plan (NAP) for Climate Change Impacts (2016-2025)** (Click [here](#))

The National Adaptation Plan for Climate Change Impacts in Sri Lanka (NAP) was prepared in line with the broad set of guidelines set forth by the UNFCCC for the development of national adaptation plans (Climate change secretariat, 2016b). See the link below for NAP.

- **The Long-Term Electricity Generation Expansion Plan (2015-2032)** (Click [here](#))

The report captures two possible approaches when responding to climate change such as mitigation and adaptation measures in the energy sector (Ceylon Electricity Board, 2013). See the link below for the above plan.

- **National Biodiversity Strategic Action Plan (NBSAP) (2016-2022)** (Click [here](#))

This integrates climate change considerations such as coastal flooding, salinity intrusion, changes in ocean wave currents, etc. (Unit, B. 2022). See the link below for the NBSAP.

- **Coastal Zone and Coastal Resources Management Plan of 2018** (Click [here](#))

This plan focuses on shoreline management, conservation of coastal habitats, control of coastal water pollution, dealing with special management areas, and improving regulatory mechanisms (Vizzuality, 2022).

See the link below for the Coastal zone management plan.

- **Sector Vulnerability Profiles: Water, Health Agriculture and Fisheries, Urban Development, Human Settlements and Economic Infrastructure (2007-2016)** (Click [here](#))

These profiles highlight key climate change related issues and risks while setting out the importance of strategically adopting climate change adaptation measures to meet these risks without interrupting the country's national development agenda (Climate Change Secretariat, 2010).

- **National REDD+ Investment Framework and Action Plan (NRIFAP)** (Click [here](#))

This plan strengthens the sustainable management of forest plantations. Planted forests can be effective in sequestering carbon and therefore in mitigating climate change (UN-REDD PROGRAMME, 2022).

4.2.4. Available Databases and Viewers

The following bullet points indicate the existing databases and e- repositories in Sri Lanka that can be utilized for climate adaptation. Majorly, e-repositories share different kinds of publications that can be used in climate change adaptation research and initiatives. Other databases provide statistical and spatial data which can also be used in climate adaptation research and initiatives.

Databases

- **Open Data Initiative of the Government of Sri Lanka** (Click [here](#))

This is an open data-sharing portal which provides access to data pertaining to sectors such as economic, demographic, transport, etc., for the general public. However, the available data sets

are very limited. These types of data would be helpful in decision-making activities for climate change adaptation.

- **Risk Info database of Disaster Management Center Sri Lanka** (Click [here](#))

This database consists of freely downloadable spatial data (categories of roads, administrative boundaries, forests, and flood-affected areas).

- **Disinventra of Disaster Management Center Sri Lanka** (Click [here](#))

This is an open-source database which provides data (statistical, spatial, and reports) on post-disaster incidents from 1974 to date.

- **Database of Department of Meteorology** (Click [here](#))

This database provides data to relevant parties at a given price. Data related to weather and climate, sea levels, tidal data etc. could be obtained from the Department of Meteorology.

- **Geological records, building material records of the National Building Research Organization (NBRO)** (Click [here](#))

This database provides spatial data related to landslides, ambient air quality, rainfall, etc. Most data are accessible via the internet. However, users have to pay a considerable amount to retrieve the data. Further, reports and other publications are available on the website.

Repositories

- **Sri Lanka Climate Change Knowledge Repository** (Click [here](#))

This database is governed by the Climate Change Secretariat (CCS) of Sri Lanka. It consists of reports and publications that have been published thus far on climate change adaptation and mitigation. All publications are freely available and can be downloaded (Climate Change Secretariat, 2022).

- **National Science Foundation of Sri Lanka, National e-Repository** (Click [here](#))

This e-Repository of the National Science Foundation of Sri Lanka shares publications regarding climate adaptation and mitigation (National Science Foundation, 2019). All publications are freely available and can be downloaded.

- **Sri Lanka Journals Online** (Click [here](#))

This e-Repository shares publications regarding climate adaptation and mitigation. All publications are freely available and can be downloaded (Sri Lankan Journals Online, 2022).

- **Coconut Research Institute Sri Lanka Repository** (Click [here](#))

This repository provides freely available publications related to adaptation measures specifically on coconut cultivation.

- **Central Environmental Authority Repository** (Click [here](#))

This database hosts, preserves, and disseminates full texts of scholarly papers produced by members of the institute. In addition, it shares several other environmental profile data. All these can be freely downloaded.

- **Hector Kobbekaduwa Agrarian Research and Training Institute** (Click [here](#))

This repository preserves and offers access to full scholarly articles of Sri Lankan origin. Publications related to climate change adaptation are available.

- **Rubber Research Institute of Sri Lanka Repository** (Click [here](#))

This repository provides access to full scholarly articles of Sri Lankan origin. This consists of publications related to climate adaptation, specifically on rubber cultivation.

- **Tea Research Institute of Sri Lanka Repository** (Click [here](#))

This also provides access to scholarly articles of Sri Lankan origin and consists of articles related to climate adaptation in tea cultivation.

E- Repositories of Sri Lankan Universities

The following E-Repositories of Sri Lankan universities provide access to publications related to climate adaptations.

- Repository: the South Eastern University of Sri Lanka (Click [here](#))
- E – Resources: University of Sri Jayawardanapura – Sri Lanka (Click [here](#))
- Digital Archive: The Open University of Sri Lanka
- Digital Library: University of Peradeniya – Sri Lanka (Click [here](#))
- Institutional Repository: University of Ruhuna – Sri Lanka
- Institutional Repository: Rajaratha University of Sri Lanka
- E – Repository: University of Colombo – Sri Lanka
- Institutional Repository: University of Moratuwa – Sri Lanka (Click [here](#))
- Institutional Repository: Eastern University of Sri Lanka

4.2.5. Available Regulations and Guidelines

The following regulations and guidelines can be applied in climate adaptation.

- **World Meteorological Organization (WMO) Regulations** (Click [here](#))

The regulations state that defining standards and best practices for climate observations is critically important universally. Identified meteorological data will help in decision making activities related to climate change adaptation (World Meteorological Organization, 2021). See the below link for the WMO regulations.

- **Environmental Impact Assessment (EIA) guidelines** (Click [here](#))

This ensures that development options under consideration are environmentally sound and sustainable and that environmental consequences are recognized and taken into account early in the project design stage (Central Environmental Authority, 2022). See the below link for the EIA guidelines.

- **Guidelines of National Building Research Organization (NBRO)** (Click [here](#))

These guidelines assist in the planning, conducting and reporting geotechnical related construction of a proposed development. This would control the construction in risk areas and necessary precautionary methods for construction.

4.2.6. Software/Hardware/Scientific Facilities

- Mapping Software
Softwares such as Arc GIS 10.8 and Arc GIS Pro are important in identifying vulnerable areas to climate change
- Hydraulic modelling software
HEC-HMS, SWAT, HEC-RAS, HEC-ResSim

- Open-source software
MOLUSCE (for Land use change analysis, Land surface change analysis)
LiDAR Data - For thermal comfort analysis
- Design Builder
- MATLAB, Python Platform - For analysing the climate data

4.3. Sweden

4.3.1. Regulatory Instruments

- **Plan and Building Act** (Plan- och bygglagen, Förordning 2010:900)

Regulates who is allowed to build and how that may be done. The key part is that only the municipality has the power to start a building process.

- **The Environmental Charter** (Miljöbalken, Förordning 1998:808)

Promotes sustainable development and is construed to protect certain key areas such as biodiversity, human health, natural and cultural environments etc.

- **Ordinance of governmental agencies climate adaptation work** (Förordning om myndigheters klimatanpassningsarbete, Förordning 2018:1428)

Lays out the broad overall strategy of Sweden's climate adaptation efforts on a national scale. It specifically dictates which governmental agencies that must work with climate adaptation.

4.3.2. Financial Instruments

- **MSB (Swedish Civil Contingencies Agency) fund for natural accidents**

Municipalities can apply for money from this fund to reduce the impacts of a natural disaster, although criticized in a multiple way this fund has grown a lot in recent years.

Municipalities can introduce a tax, or a fee, to raise money for climate adaptation efforts. Although, no one has this yet, and it is a legal grey zone for what that money can be spent on (Von Bahr and Ivarsson, 2020)

Beyond these two there are no major ways to finance besides letting the property owner do it themselves or apply for funds on an EU-level. SMHI has a webpage dedicated to help with where you can find funds, see references.

4.3.3. National Strategies and Plans

- **The expert council of climate adaptation first report released in February 2022.**

The expert councils' reports attempt to guide actors on what to do. They included 168 suggestions for how to increase the resilience of Sweden towards climate change.

4.3.4. Available Databases and Viewers

- **Swedish meteorological institute's (SMHI) climate adaptation portal.**

This portal has helpful information regarding financing, examples, top tips, etc. from all over Sweden.

- **Flooding portal from the Swedish Civil Contingencies Agency (MSB).**

This portal contains information and tips for flooding along rivers in Sweden, mainly focusing on the larger rivers (Myndigheten för samhällsskydd och beredskap, n.d.)

- **Map-tool for erosion and landslides developed by a coalition of governmental agencies.**

This highlights risky areas when it comes to land and soil stability, it also contains guidance of how to treat these risks and how to interpret the maps.

4.3.5. Available Guidelines

- **Flooding directive from the EU**, which informs work done by MSB and the water and sea authority.

This directive aims to synchronize how member-states work with flooding issues across the EU (European Union, 2007).

- **The housing authority's (Boverket) guidelines for climate adaptation in the planning process.**

This guidance is used by most municipal and regional planners as a knowledge bank for how to interpret situations within the planning process.

- **Swedish water's guidelines for downpour calculations** (Svenskt vatten)

These guidelines inform officers in the field of how to plan for downpours, and by what magnitude future climate effects should be taken into account. Their recommendation of a 'climate factor', multiplying historical downpour accounts by 1.2-1.4, is praxis in the field (Svenskt vatten, 2020).

4.3.6. Software/Hardware/Scientific Facilities:

- **GIS (Geographic information systems)** is the most important mapping tool for climate adaptation officers. It is mainly used as input for adaptation efforts.
- **Scalgo** is another mapping tool that specializes in rainfall and downpour. One interviewee described it as being a good, and user-friendly, visualization tool for downpour.

4.3.7. Others

- For people working with climate adaptation the broader plans, such as oversight plans or regional development strategies, are key pieces of documentation for involving climate adaptation plans to regional development.
- Collaboration forms, although largely lacking in the Swedish context, is something that many interviewees highlighted as a key strategy to overcome resource- and knowledge deficits. The most talked about include RKS (Regional coastal collaboration), Erosionsskadecentrum (Erosion damage centre), Göteborgsregionen kommunalförbund (Gothenburg region municipal alliance).
- EU taxonomy is an essential incentive for the private sector to become more aware of their environmental impact. Although this is mainly for mitigation purposes, it can also contribute to a general awareness of climate dangers and adaptation strategies for combatting these.

4.4. UK

4.4.1. Regulatory Instruments

- **Climate Change Act 2008**

The Climate Change Act 2008 is the basis for the UK's approach to tackling and responding to climate change. It requires that emissions of carbon dioxide and other greenhouse gases are reduced and that climate change risks are adapted to. The Act also establishes the framework to deliver on these requirements. The Act supports the UK's commitment to urgent international action to tackle climate change.

- **Subsidy Control Act 2022**

The Act has a whole schedule (Schedule 2) on environmental principles for the issuance of subsidies. This schedule notably states that subsidies in the form of compensation for electricity-intensive users given in the event of an increase in electricity costs resulting from climate policy instruments shall be restricted to sectors at significant risk of carbon leakage due to the cost increase.

- **Environment Act 2021**

This act aims to improve air and water quality, tackle waste, increase recycling, halt the decline of species, and improve the country's natural environment to make it more resilient to climate shocks.

- **Budget 2021**

The 2021 Budget, announced by the UK Treasury in March 2021, contained a number of references to net-zero targets. Through the budget, the UK's Net Zero target has been made part of the UK Government's "overall economic policy objective" and as a result is to be incorporated into the remit of the Bank of England. The budget also includes plans for a new National Infrastructure Bank with £22 billion of financing and the issuance of the UK's first green government bond or gilt.

- **Energy Act 2016**

The Energy Act 2016 formally establishes the Oil and Gas Authority (OGA), sets its regulatory powers, and regulates onshore wind power. According to the new strategy the OGA has a new mandate to both "secure that the maximum value of economically recoverable petroleum is recovered from the strata beneath relevant UK waters" and, in doing so, "to take appropriate steps to assist the Secretary of State in meeting the net zero target."

- **Pension Schemes Act 2021**

Section 124 of the Pension Schemes Act 2021 amends the Pensions Act 1995 to allow for the creation of regulations that may impose climate change related requirements on the trustees or managers of an occupational pension scheme of a prescribed description. Requirements may relate to both climate risks and opportunities, and cover both physical risks and transition risks.

- **Agriculture Act 2020**

The Agriculture Act 2020 establishes a new system of agricultural subsidies, replacing the Common Agricultural Policy of the European Union following the UK's withdrawal from the European Union. Section 1(1) of the Act provides that financial assistance may be provided to those involved in agricultural, horticultural, or forestry activities for a number of purposes, including "managing land, water, or livestock in a way that mitigates or adapts to climate change."

- **Climate Change Agreements**

Climate Change Agreements (CCAs) are voluntary agreements that allow energy intensive business users to receive a discount from the Climate Change Levy of up to 90% of the Levy, in return for meeting energy efficiency or carbon-saving targets.

- **Finance Act 2020**

The Finance Act 2020 makes several provisions for changes to the UK's existing carbon tax and carbon pricing regimes. The changes to the Climate Change Levy reflect the changes in the fuel mix used in electricity generation and the increase in rates seeks to recover tax revenues lost due to the closing of the Carbon Reduction Commitment (CRC) Energy Efficient Scheme.

- **Climate Change Levy**

The Levy applies to electricity, gas, solid fuel and liquefied gases used for lighting, heating and power in the business and public sectors. The Levy was designed to be broadly revenue neutral in concept: at the time of introduction, it formed part of a 'Levy Package' where the revenue collected is recycled back to business through a 0.3% reduction in National Insurance Contributions and also a system of enhanced capital allowances for investments in energy saving technologies.

- **Carbon Budget Order 2016**

The Carbon Budget Order 2016 sets the carbon budget for the 2028-2032 budgetary period as 1,725,000,000 tonnes of carbon dioxide equivalent (including emissions from international shipping). The budget limits annual emissions to an average 57 per cent below 1990 levels.

- **Infrastructure Act 2015**

This act makes provisions for a range of infrastructure projects and strategies across the country. It notably makes provisions to enable building regulations to provide for off-site carbon abatement measures.

- **Finance Act 2011**

The primary legislation for the introduction of a Carbon Price Floor (CPF). Supplies of coal, gas and liquefied petroleum gas (LPG) used in most forms of electricity generation become liable to newly created Carbon Price Support (CPS) rates of climate change levy (CCL), which are different from the main CCL rates levied on consumers' use of these commodities (and electricity). The amount of fuel duty reclaimable on oil used in electricity generation is adjusted to establish new CPS rates of fuel duty.

- **UK Flood and Water Management Act - 2010**

This Act makes provisions about water, including provisions about the management of risks in connection with flooding and coastal erosion. Article 7.2 specifies that the Environment Agency must specify the current and predicted impact of climate change on flood and coastal erosion risk management when coming up with a national flood and coastal erosion risk management strategy for England.

- **Climate Change and Sustainable Energy Act**

The Act contains several measures to monitor and promote energy efficiency and establishes a scheme to promote national targets for micro-generation. It provides for a green certificate scheme for electricity from renewable sources and for reporting

on the energy efficiency of residential accommodation. The Act placed an obligation on Defra to report to parliament on GHG emissions and on action taken by the government to reduce these emissions. The first report was put to the UK parliament in 2007.

- **Company Car Tax Reform**

In 2002, the UK Company Car Tax system was revised to be carbon-based. All company cars first registered after January 1998 are taxed on a percentage of their list price according to CO2 emission bands, measured in grams per kilometre (g/km). The reform was intended to remove the perverse incentive in the existing system to reduce the tax due by driving unnecessary extra business miles and to provide a significant incentive to company car drivers to choose more fuel-efficient vehicles.

4.4.2. Financial Instruments

- **Green Finance Strategy**

This document aims to set out a comprehensive approach to greening financial systems, mobilizing finance for clean and resilient growth, and capturing the resulting opportunities for UK firms.

- **Energy Savings Opportunity Scheme**

In 2014, the UK Government established the Energy Savings Opportunity Scheme in order to comply with E.U. Energy Efficiency Directive (Directive 2012/27/E.U.).

- **Bio-energy Capital Grants Scheme**

Supports biomass-fuelled heat, and CHP projects in the industrial, commercial and community sectors in England. Six rounds of funding have been provided since the Scheme was launched in 2002.

- **Feed-in Tariffs for renewable electricity**

Offers feed-in tariffs (FITs) for small-scale low-carbon electricity installed by householders, businesses and communities, even if the electricity is consumed on-site. Additional payment is provided for electricity fed into the grid.

- **Water Act 2014 (creation of Flood Re scheme)**

Flood Re is a hybrid public-private reinsurance scheme introduced by the UK Government under Part 4 of the Water Act 2014. It was designed in partnership with insurers aimed at making the flood cover part of household insurance policies more affordable. Every insurer that offers home insurance in the UK is required to pay into the Flood Re Scheme. Funds from this levy are then used to cover the flood risks in home insurance policies.

- **Preferential Tax Regimes for Biofuels**

A reduced excise duty rate was introduced for biodiesel in July 2002 and bio-ethanol in 2005. Producers of bio-blend and bio-ethanol blend will also benefit from the reduced rate of excise duty, as the proportion of biodiesel or bio-ethanol in the blend bears the lower rate of excise duty.

4.4.3. National Strategies and Plans

- **UK Climate Change Risk Assessment (CCRA)**

The Climate Change Act requires the UK Government to produce a UK Climate Change Risk Assessment (CCRA) every five years. The CCRA assesses current and future risks to and opportunities for the UK from climate change.

- **National Adaptation Programme (last version covering 2018-2023)**

In response to the CCRA, the Climate Change Act also requires the UK government to produce a National Adaptation Programme (NAP). The Act also gives powers to the UK Government to require certain organizations to report on how they are adapting to climate change. The National Adaptation Programme (NAP) document - covering England only - sets out a register of actions agreed under the programme, aligns actions being taken with the risks identified in the 2012 Climate Change Risk Assessment (CCRA), and establishes timeframes for actions.

- **Resilience for the future: The UK's critical minerals strategy**

This UK government's strategy on critical minerals centres on three concepts: acceleration, collaboration, and enhancement. It recognizes the needs for enhanced resilience in the low-carbon transition, and to access a steady supply of critical minerals.

- **Jet zero strategy**

This document sets the government's decarbonization vision for the aviation sector in order to enable the country to meet its 2050 net zero target.

- **Boiler Upgrade Scheme (BUS)**

The scheme aims at encouraging property owners to install low carbon heating systems such as heat pumps, by providing grants to help overcome the upfront cost of low carbon heating technologies.

- **Energy Security Strategy (UK)**

This document was released in the wake of rising energy prices notably induced by consequences of the COVID-19-induced economic crisis and the invasion of Ukraine. It builds on policies set out in the "ten-point plan for a green industrial revolution" and the "net zero strategy".

- **The Limited Liability Partnerships (Climate-related Financial Disclosure) Regulations 2022, made under the Limited Liability Partnerships Act 2000**

These regulations impose an obligation on all Limited Liability Partnerships that meet threshold criteria to include information on climate related financial risks in their strategic reports.

- **The Companies (Strategic Report) (Climate-related Financial Disclosure) Regulations 2022, made under the Companies Act 2006**

These regulations impose an obligation on all companies that meet threshold criteria to include information on climate related financial risks in their strategic reports.

- **CCUS Investor Roadmap**

This document reasserts the UK's place on CCUS as a "first mover" and seeks to attract engineers and funders to develop capacity in the country.

- **Hydrogen Investor Roadmap**

This roadmap builds on the UK Hydrogen Strategy and defines how the government seeks to attract investors to develop hydrogen production in the country.

- **Automotive (investor) roadmap**

This document sets the government's roadmap to enable the automotive sector and its entire supply chain to embark on the decarbonization road.

- **The Greenhouse Gas Emissions Trading Scheme Order 2020**

This order established a new UK emissions trading regime as the successor to the E.U. Emissions Trading Scheme following the UK's Withdrawal from the European Union.

- **Net Zero Strategy: Build Back Greener**

This strategy sets out sectoral policies and proposals for decarbonizing all sectors of the UK economy to meet the net zero target by 2050. It sets sectoral targets as well as jobs creation targets. It aims to enable the delivery of the objectives set out in the Ten Point Plan.

- **Greening Finance: A Roadmap to Sustainable Investing**

This document details Sustainability Disclosure Requirements to help businesses prepare for what they will have to report and by when, details the UK Green Taxonomy, Highlight the importance of investor stewardship in green finance and set out the government's expectation.

- **Heat and buildings strategy**

This document sets out the government's vision for high-efficiency, low-carbon buildings, to enable a greener future with enhanced business and job opportunities.

- **UK Hydrogen Strategy**

This document sets the government's strategy to create an integrated low-carbon hydrogen sector in the UK.

- **Transport Decarbonisation Plan**

This plan sets out the government's commitments and the actions needed to decarbonize the UK's transport system.

- **National Planning Policy Framework**

The National Planning Policy Framework sets out the Government's planning policies for England and how they should be applied in the context of local development plans and planning decisions.

- **England Trees Action Plan 2021 to 2024**

This document identifies tree cover as an essential instrument for the UK to mitigate its GHG emissions, adapt to adverse effects of climate change and create economic opportunities.

- **England Peat Action Plan**

This document seeks to make the country's peatlands meet their Net Zero contribution, but also contribute to wider environmental goals.

- **North Sea Transition Deal**

The stated aim of the North Sea Transition Deal is to maximize the "advantages for the UK's oil and gas sector from the global shift to clean growth".

- **Industrial Decarbonisation Strategy**

This strategy, presented to parliament by the Department for Business, Energy, and Industrial Strategy, sets out the UK government's approach to decarbonization in key industrial sectors.

- **Bus Back Better: national bus strategy for England**

This strategy aims to bolster the use, quality, and sustainability of buses across the country. The measures include a simplification and lowering of fares, enhanced service, delivery of 4,000 new electric or hydrogen buses, and end sales of new diesel buses.

- **Net Zero Innovation portfolio**

The Net Zero Innovation Portfolio establishes a £1 billion fund to accelerate the commercialization of new technologies to advance decarbonization in the UK.

- **Motor Fuel (Composition and Content) and the Biofuel (Labelling) (Amendment) Regulations 2021**

These regulations modify the existing regime governing the composition of motor fuel and introduce new labelling requirements for biofuels.

- **Carbon Accounting (Provision for 2019) Regulations 2021**

These regulations set out the Carbon Accounting requirements to be used in calculating the UK's 2019 carbon budget and are relevant for the UK's third carbon budget under the 2008 Climate Change Act.

- **Financial Conduct Authority Rules on TCFD**

As of December 2020, the UK's Financial Conduct Authority issued new rules requiring publicly listed companies incorporated in the UK to either comply with the recommendations of the Task Force for Climate related Financial Disclosure.

- **Energy White Paper**

In December 2020 the UK Secretary for Business, Energy, and Industrial Strategy issued an Energy White Paper entitled "Powering our Net Zero Future". The aim of the White Paper is to transform energy, support a green recovery from the COVID19 crisis and create a fair deal for consumers.

- **National Infrastructure Strategy**

This strategy notably aims to enhance the country infrastructures' quality and to enable the overall net zero emissions goal by 2050.

- **Ten Point Plan**

In November 2020 UK Prime Minister Boris Johnson outline a Ten Point Plan for a Green Industrial Revolution.

- **Gear Change, a bold vision for cycling and walking (Cycling and walking plan for England)**

This document aims to foster walking and cycling in England.

- **A plan for jobs**

This document is the UK's policy response to the COVID-19-induced economic crisis. It outlines a number of stimulus measures, including a "green homes grant" scheme budgeted at 2 billion pounds aimed at enhancing energy efficiency, and a 1.1-billion-pound plan to decarbonize the public sector.

- **Marine Strategy Part One: UK updated assessment and Good Environmental Status**

This strategy aims to achieve Good Environmental Status (GES). The 2019 updates of the Strategy's Part One highlight in part 2.3 the importance of blue carbon and nature-based solutions for climate mitigation and adaptation efforts.

- **Clean Growth Strategy**

The Clean Growth Strategy exposes how the Government intends to foster national income while reducing greenhouse gas emissions and do so at the least possible cost for taxpayers while maximizing the social and economic benefits.

- **Cycling and walking investment strategy**

This strategy aims at making cycling and walking increasing "natural choices" for short trips and part of longer trips. It also sets short term objectives, details financial resources available, discusses indicators and sets governance arrangements to be put in place in the future.

- **Carbon Plan**

The Carbon Plan replaced the 2009 Low Carbon Transition Plan. The Plan sets out how the UK will achieve decarbonization within the framework of energy policy - making a transition to a low carbon economy while maintaining energy security and minimizing costs to consumers.

- **Low Carbon Transport Innovation Strategy**

The Strategy sets out a wide range of actions that the UK is taking to encourage innovation and technology development in lower carbon transport technologies, including stimulating investment in a broad range of research and development activities.

4.4.4. Available Databases and Viewers

- **UK climate change statistics portal**

A new UK climate change statistics portal has been launched. It's an accessible one-stop shop for statistics on climate change and related topics, including drivers like energy use and emissions levels, giving clear, accessible, and accurate information.

- **Met Office- UK climate maps and data**

The Met Office holds the nation's weather and climate records.

- **UKCP summaries and headline findings**

Summaries of the key information from the latest set of UK Climate Projections (UKCP). Includes data from local, high (2.2 km) resolution to global, coarser (60 km) resolution, in a range of formats.

- **Headline findings**

A summary of the most important information from our latest climate projections, with key messages for decision-makers.

- **Climate change projections over land**

Pre-prepared images of key results from the Probabilistic Projections for precipitation and temperature changes over land in the UK.

- **Marine climate change projections**

Summary material including a spreadsheet for sea-level changes and a factsheet on the marine projections for the UK.

- **UKCP data**

Through this, it is possible to download and customize climate projections for any region in the UK by using the UKCP User Interface.

- **CEDA catalogue**

Access datasets not included in the UKCP User Interface. For example, UKCP Global (60km) and UKCP Regional (12km) data for other parts of the world in the CEDA catalogue could be accessed.

- **UKCP data factsheets**

A collection of documents that provide a short overview of the projections for different products and metrics, such as temperature or precipitation.

4.4.5. Available Guidelines

- **Guidance for local government on preparing for a changing climate.**

This guide focuses on preparing for the impacts of climate change, a process known as climate change adaptation. It does not cover approaches to reducing emissions of greenhouse gases, which are the drivers of climate change, often referred to as mitigation. This guide is designed for a wide range of officers working to implement adaptation within local government.

- **Preparing for Climate Change: A Climate Change Adaptation Strategy**

Prepared by the Ministry of Justice (MoJ) to provide a clear outline of what is required to enable the MoJ, including Executive Agencies and Non-Departmental Public Bodies, to prepare for climate change.

- **Code for Sustainable Homes**

Building on the recommendations of the Sustainable Buildings Task Group, the Code was developed to support a step change in the building of sustainable new homes. The Code provides a single national standard to guide the industry in the design and construction of sustainable homes.

4.4.6. Software/Hardware/Scientific Facilities

- **CCWeatherGen: Climate Change Weather File Generator for the UK**

The climate change weather file generator (CCWeatherGen) enables to generate climate change weather files for the UK ready for use in building performance simulation programs. It uses the 2002 climate change scenario predictions provided by the UK Climate Impacts Programme (UKCIP).

- **Climate X**

Climate X has created a platform to monitor and detect extreme weather events and the risks they pose to physical assets.

- **Airex , London - Buildings**

Airex has a mission to end fuel poverty. Aiming to reduce home energy consumption, Airex is an IoT-enabled smart ventilation control that helps reduce heat demand in homes, whilst managing indoor air quality.

- **Boxergy, Edinburgh, Scotland - Energy and Electricity**

Boxergy’s mission is to provide home energy cheaper, greener, and smarter by selling it, and the hardware required, as a service. Their Hero platform brings together existing low-carbon technologies to maximise efficiency and integrates them with their smart tariff. This allows customers to buy energy when it's cheap and green and use it when they want.

- **Circular, London - Supply Chain**

Circular empowers businesses to fully manage their supply chains and drive responsible sourcing and recycling. Circular creates an immutable record of the chain of custody of materials, linking the end products to their source. This traceability data also enables organisations to make informed decisions to reduce their carbon footprint.

4.5. Malta

4.5.1. Regulatory Instruments

- L.N. 134 of 2020 - Energy Performance of Buildings (Amendment) Regulations, 2020
- L.N. 47 of 2018 Building Regulation Act (CAP. 513) Energy Performance of Buildings Regulations, 2018
- The near-zero energy building status for public buildings (NZEB) by 2018, and all other buildings by end-2020.
- EPC for design and asset ratings and obligation to display certificates.
- Parking Places Regulations (L.N. 25 of 1961)
- Motor Vehicles (Tariff of Fares) Regulations(L.N. 14 of 1982
- Quality of Fuels Regulations (L.N. 44 of 2008)
- Infrastructure for Spatial Information Regulations (L.N.339 of 2009)
- Waste Regulations LN 184 of 2011
- Deposit of Waste and Rubble (Fees) Regulations LN 128 of 1997
- LN 22 of 2009 on Waste Management from Extractive Industries Regulations
- The National Renewable Energy Action Plan 2015 – 2020, Energy and Water Agency
- LN 538/2010, Promotion of Energy from Renewable Sources Regulations
- Energy and Climate Plan, 2019
- CAP 623 – Building and Construction Authority Act
- SL 623.01 – Energy Performance of Building RegulationsSL 623.03 – Energy Performance of Building (Fees) Regulations
- SL 623.04 Conservation of Fuel, Energy and Natural Resources (Minimum Requirements on the Energy Performance of Buildings Regulations)
- SL 623.05 – In Building Physical Infrastructure (Access to Electronic Communication Services) Regulations
- SL 623.06 – Avoidance of Damage to Third Party Property Regulations
- SL 623.07 – Energy Efficiency Regulations
- SL 623.08 – Construction Site Management Regulations

- **Construction Products Regulations (305/2011)**

The Regulation Basic Requirement No 7 'Sustainable use of natural resources' refers to the following: 'The construction works must be designed, built and demolished in such a way that the use of natural resources is sustainable and in particular ensure the following: (a) reuse or recyclability of the construction works, their materials and parts after demolition; (b) durability of the construction works; (c) use of environmentally compatible raw and secondary materials in the construction works.' The exploitation of waste products to enhance the performance characteristics of mortars contributes towards this requirement.

4.5.2. Financial Instruments

Financing the transition to a circular, carbon neutral society, in its many aspects, is crucial to the success of the national goal of achieving climate neutrality by 2050. It is necessary to ensure that climate policy is financed in a sustainable manner and that it is implemented efficiently, and in line with the country's long-term objectives, avoiding financing investments that are not in line with this objective and enhancing the creation of new clusters in the country. For this reason, it is essential to foster the development of a favourable environment for sustainable financing and greater involvement of the financial system.

- **The 2021-2027 Multiannual Financial Framework**
- **Action Plan for Financing Sustainable Growth**
- **LIFE Program**
- **InvestEU**
- **The Connecting Europe Facility (CEF)**
- **The European Regional Development Fund**
- **Horizon 2020 and the subsequent Horizon Europe, Innovation Fund**

The national climate policy also benefits from the allocation of an important group of revenues generated by the climate policies themselves. One would need to identify any possibly national financing instruments readily available which embodies decarbonisation of the economy as one of the structuring areas.

One should consider the use of revenue generated from auctioning of EU ETS allowances, also taking into account the list of areas identified in the EU ETS Directive (Article 10(3)) including point "*(h) measures intended to improve energy efficiency, district heating systems and insulation, or to provide financial support in order to address social aspects in lower- and middle-income households*".

One other element that should be looked into is the need to ensure that low-income households can also participate in the decarbonisation of Malta's economy and can also benefit from such decarbonisation.

- **Corporate green bonds**
- **Sovereign green bonds**
- **Green Loans**
- **Sustainable investment funds**
- **Blended Finance**

4.5.3. National Strategies and Plans

- **The National Climate Change Adaptation Strategy for Malta** (Click [here](#))

The National Adaptation Strategy seeks to address recommendations in various sectors which are vulnerable to climate change, viz. water, agriculture, human health and tourism. The strategy also addresses the financial impacts as well as any sustainability issues. There is an emphasis on the need for a legal framework which will address the important matter of adaptation adequately.

The Strategy clearly outlines the policy which should be adopted and it indicates which Authority or Government entity is responsible for the implementation. Time-frames within which such policy actions should be implemented are also included

- **Malta Low Carbon Development Strategy** (Click [here](#))

In line with this, the EU has a long-term strategy to achieve climate neutrality by 2050, under which each Member State is required to plan and communicate a Low Carbon Development Strategy (LCDS or “Strategy”) out to 2050. Mitigation measures have been researched and possible abatement levels quantified through Marginal Abatement Cost Curve modelling (i.e. ratio of abatement potential against incremental cost of measure), and stakeholder consultation, leading to a list of realistic and cost-effective measures. The measures cover seven different sectors namely:

Energy, Transport, Buildings, Industry, Waste, Water and Agriculture and land-use, land-use change and forestry (LULUCF), aimed to achieve target reductions in greenhouse gas emissions by 2050 and also enabling Malta to reach its targets by 2030. In addition, it includes adaptation measures, proposing initiatives which will help the country be resilient in the face of Climate Change impacts which are already hitting our islands. The adaptation measures aim to address the specific risks and vulnerabilities which Malta faces given its nature as a small island state.

- **Malta’s Research and Innovation Smart Specialisation Strategy (RIS3) 2021-2027**

One of the aims of this strategy is aimed at the sustainable use of resources by turning waste into a resource. This current project aims at both the sustainability of local poultry industry (with the producer as the main stakeholder) and sustainability of the local environment (with the citizen as the main stakeholder) by reducing the polluting impact of poultry industrial waste and by utilizing this waste for nutrient recycling as a fertilizer and for structural purposes as building material.

- **Malta Low carbon development strategy (2021)**

The LCDS presents measures, covering seven different sectors including: Energy, Transport, Buildings, Industry, Waste, Water and Agriculture and land-use, land-use change and forestry. The objective is to achieve reductions in greenhouse gas emissions by 2050 and enabling Malta to reach its targets by 2030. LCDS includes adaptation measures, for increased resilience with respect to Climate Change impacts. The adaptation measures aim to address the specific risks and vulnerabilities which Malta faces as a small island state. The LCDS refers to key elements in construction including: Exploring economic incentives targeting recycled materials in construction.

4.5.4. Available Databases and Viewers

- **MARIA/Eta High Resolution Atmospheric Forecasting System for the Central Mediterranean and Maltese Islands** (Click [here](#))

The Malta Blue Pages is an internet-based directory system for ocean & marine data and information, targeting to establish a single-point online reference, access and repository for a number of marine data sources and descriptions in the field of marine environmental and oceanographic data in Malta.

- **MARIA/Wave forecasting system at IOI-Malta** (Click [here](#))

The operational wave forecasting system at the IOI-Malta Operational Centre, University of Malta uses the 3rd generation spectral wave model WAM Cycle 4 (Gunther et al, 1992). Originally developed by Hasselmann, the WAM model has been later extended by the WAMDI group (The WAM Development and Implementation Group).

- **Malta Shelf Hydrodynamical Model – ROSARIO** (Click [here](#))

The operational shelf scale forecasting system for the Malta Shelf Area runs in slave mode, through the daily re-initialization from the Sicily Channel Regional Model (SCRM) daily averaged forecast fields at day J (corresponding to Day 0 of the Malta shelf model) and the forcing at the lateral boundaries by SCRM fields in the subsequent days.

- **Malta GPS Wave Buoy Interface** (Click [here](#))

The deployment of the GPS directional wave buoy in Gozo forms part of the NEWS (Nearshore hazard monitoring and Early Warning System) project led by the Università degli Studi di Enna “Kore”. The project is partially funded by ERDF funds through the Italia-Mala Interreg V-A Operational Programme (2014-2020). NEWS tackles the coastal erosion risks on the southern coast of Sicily and the Maltese Islands. Coasts are subjected to fast erosion due to natural and anthropic causes which involve the failure of cliffs, the triggering of localized erosions and the possibility of flooding. NEWS deals primarily with the modelling and monitoring of coastal risk processes, including the design of alert components against major risks. The system will make use of an integrated geophysical sensor network on land as well as a networked set of wave buoys installed offshore Sicily and the Maltese Islands.

4.5.5. Available Guidelines

- **Technical Document F (Part 1)**
- **Technical Document F (Part 2)**
- **Code of Police Laws**
- **Improving your Home to Save Energy and Achieve Better Comfort**
- **Standardisation of Apertures for Residential Buildings in Malta**
- **Circular Publishd in relation to Subsidiary Legislation 623.08**
- **EPC Guide to Additional Changes**

4.5.6. Software/Hardware/Scientific Facilities

- **Planning Authority Malta** (Click [here](#))
- **Planning Applications, Malta** (Click [here](#))
- **Geographic Informaiton System: Mapserves of the Planngng Authority, Malta**

The Map server of the planning Authpirty includes multiple data sets in a databse and allows for access to planning, environmental, developmentboundaries, scheduling data, base data, enforcement, schemes and other data in a Geographic informaiton referenced system for the Maltese Islands.

- **Lands Authority Plans – Survey Sheets – for the Maltese islands** (Click [here](#))
- **CESBA e learning platform – Sustainable Med Cities** (Click [here](#))

The CESBA MED project tested 10 case studies from all over Europe. A common sustainability assessment framework at urban and building scale was selected after the testing phase to support the development of energy efficiency plans for public buildings in the context of their surrounding neighbourhood.

Improving stakeholders skills by offering targeted training courses is an essential component of CESBA MED strategic overview. Two courses are offered according to the identified target groups and the two scales, building and urban. All training material is available in English and in other 5 languages (Italian, Spanish, French, Greek, Croatian).

- **Research and Training Facility – Water Tower managed by the University of Malta** (Click [here](#))

Water Tower Research and training station in new innovative durable materials for coastal environment, life time engineering, degradation of materials and structures, Sensor monitoring station.

- **Research Facilities at the University of Malta** (Click [here](#))

Various laboratories: Civil Engineering, Materials Engineering, Biology, Chemistry, other.

4.5.7. Others

A larger awareness on climate change mitigation and climate change adaptation is necessary among different stakeholders and within the structures. The increased awareness on climate change adaptation strategies can help prioritise action in entities and institutions. For example in the context of the European Green Deal, EU taxonomy for sustainable activities, as a classification system established to clarify which investments are environmentally sustainable, stakeholders can prioritise in their action whilst being aware of climate change impacts.

Various resources exist in all different government entities dealing with the following: Energy, Building, Planning, Infrastructure. These include plans or development strategies, which are key pieces of documentation related to climate adaptation plans at the national level. In addition the respective archives of the main entities including historic archives are a useful resource in analysing scenarios.

Interlinks between entities emerged as a key and important factor in the interviews. Entities tend to work independently from one another and therefore this may give rise to duplication of work. A focus action and further interlinks and collaboration is required between national entities which is likely to reduce bureaucracy and increase collaboration. This can lead to improved use of human resources and facilities and other resources, access to data.

Knowledge is a key factor which was highlighted together with reliable data and datasets which need to be available and relied upon. The key areas highlighted relate to waste data which is necessary to define policy and strategic action for implementation plans.

- **Energy Performance Certificate in Malta** (Click [here](#))

Energy Performance of Buildings in The Maltese Islands. Energy Performance Certificate Service: provides assessors and members of the general public with information and material relevant to Energy Performance Certificate services and updates.

5. Case studies and good practices

Case studies and good practices collected from Spain, Sri Lanka, Sweden, United Kingdom, Malta and other European countries are presented in individual factsheets in Annex 1. Each factsheet includes a summary and background of the case study, climate impacts that the case study intends to adapt, the actions that were taken, stakeholders involved, how the project was funded, key outcomes and benefits for the coastal communities, an overview of the barriers encountered and top tips drawn from the case study. In addition, the components of the built environment and the specific sectors addressed are differentiated to better understand the applicability of the case study.

The components of the built environment addressed by each case study have been classified into physical, economic, social, environment and governance.

Figure 2 shows the percentage of case studies included in the catalogue that address each component for each country. This classification is overlapping, that is, one case study may address more than one category.

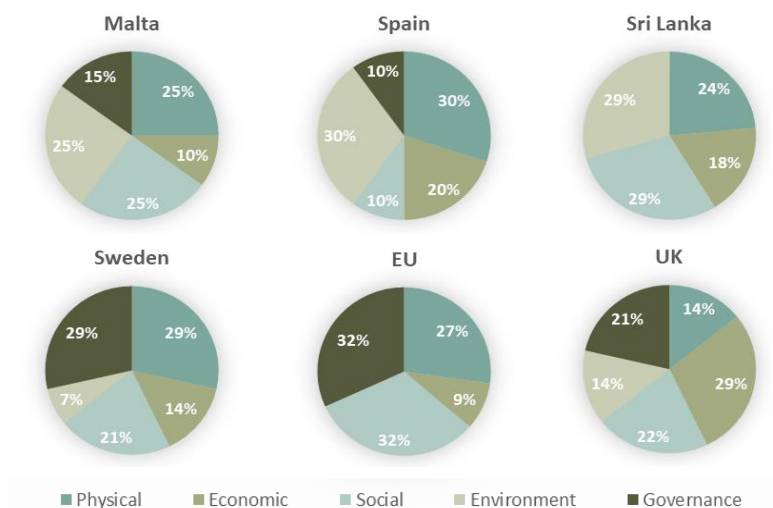


Figure 2. Percentage of case studies that address each built environment component by country.

The sectors addressed by case studies are classified into tourism, finances and insurance, fisheries and agriculture, transport and energy and urban. Figure 3. shows the percentage of case studies included in the catalogue that address each sector per country. As well as for the components, this classification is not discrete and one case study may address more than one sector.

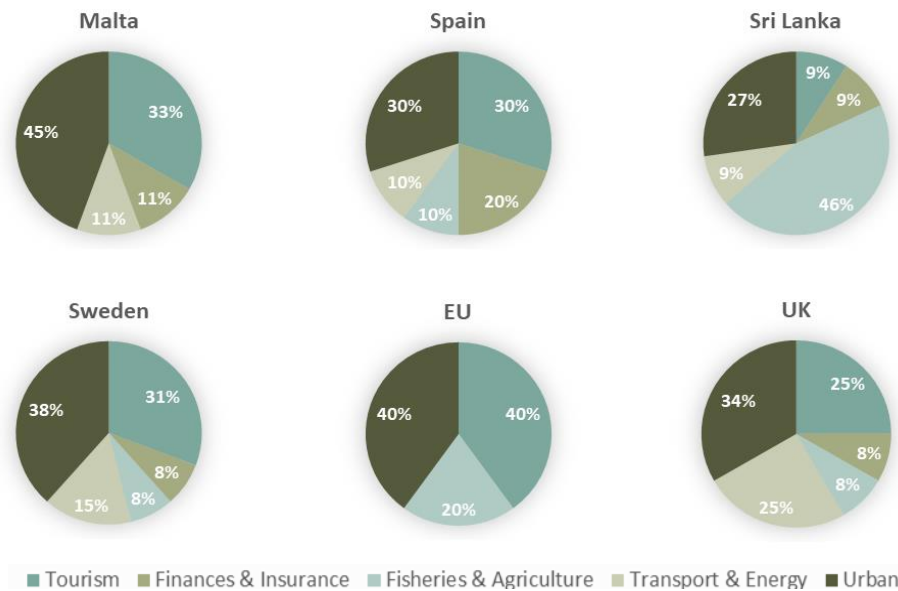


Figure 3. Percentage of case studies that address each built environment sector by country.

The catalogue of case studies presented in Annex 1 is classified and ordered according to the categories of adaptation options proposed by the IPCC in 2014 (see Table 1).

Table 1. Categories of adaptation options (IPCC, 2014).

CATEGORIES	
Structural/Physical	Engineered and built environment
	Technological
	Ecosystem-based
	Services
Social	Educational
	Informational
	Behavioural
Institutional	Economic
	Laws and regulations
	Government policies and programs

Figure 4. Case studies per category (%) presents the percentage of case studies in the catalogue per category. The "Engineered and built environment" category is the most representative of the catalogue (30%), as these measures have been traditionally adopted in many regions. Indeed,

engineering, and the multidisciplinary teams that engineers work with (architects, planners, legal experts, etc.), are often at the forefront of adaptation technologies and strategies (Dawson, 2007). However, other categories such as “Ecosystem-based” are increasing in the last few years, partly due to the support of international agencies and donors. In contrast, the social categories are the least represented among the selected case studies.

In any case, as noted in IPCC 2014, these adaptation options should be considered overlapping rather than discrete, and are often pursued simultaneously as part of adaptation plans.

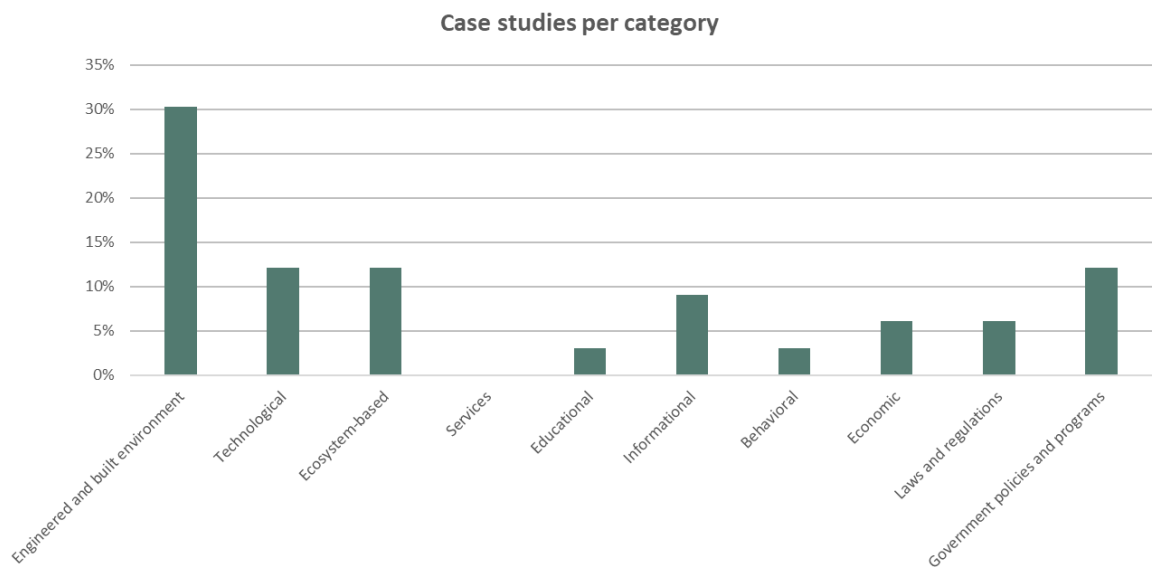


Figure 4. Case studies per category (%)

5.1. Spain

There are an increasing number of experiences, initiatives and projects aimed at developing and implementing specific actions to adapt to climate change. Due to the high vulnerability of the Spanish coastline to the effects of climate change, Spain was one of the first European countries to develop an adaptation policy, which materialized in 2006 with the approval of the National Climate Change Plan Adaptation.

In coastal areas, the General Directorate for the Coast and the Sea, under the Ministry of Environment, has large experience in coastal protection and implementation of engineering solutions to the multiple coastal problems, especially erosion and flooding, faced on the Mediterranean coast from the 50s and 60s of XX century, when there was a strong development of tourism and urban areas in the area. This agency has elaborated several strategies and plans to protect the coast, mainly based on the design of hard and soft measures. The “Engineered and built environment” adaptation option category, according to the interviewees (see next figure) is one of the most suitable categories in Spain. This could be due to the aforementioned experience in coastal engineering and management in Spain. However, engineering and hard infrastructures in the coastal areas are becoming less socially acceptable in Spain.

Stakeholders assessed the “Government policies and programs” category as adequate as “Engineered and built environment”. The [PIMA Adapta](#) initiatives contribute to climate change adaptation in the built environment. The catalogue of case studies presents two initiatives

developed under the PIMA Adapta program: “Analysis of climate-related risks in Cantabrian Coasts – proposal of adaptation options “ and “Climate change adaptation plan - Ports of Asturias”. However, there is still work to be done to mainstream climate change adaptation into municipal land use and urban planning, and stakeholders identified skill and knowledge gaps to address this. The ongoing initiatives developed in Santander and Barcelona will, for sure, inspire this process. "[Santander, Habitat Futuro](#)" focuses on an urban regenerative model so that the city will be sustainable, circular, resilient and inclusive. The Barcelona Climate Plan includes objectives and strategic measures for mitigation, adaptation and resilience, climate justice and the promotion of citizen action.

Over the engineered and government policies categories, stakeholders identified the “Informational” and “Technological” categories as the most suitable for climate change adaptation in Spain. In this regard, it is worth mentioning that Spain, through the OECC, Biodiversity Foundation and other related entities have promoted the publication of information platforms such as [AdapteCCa](#) that provides examples of case studies and information on impacts, vulnerability and adaptation to climate change where can be found, as well as spatial data repositories and geo-viewers including [the national flooding mapping system](#), and the [C3E](#) viewer including coastal hazards and impacts.

On the other side, “Behavioural”, “Economic” and “Services” are considered the less adequate measures in Spain, maybe due to the lack of knowledge and experience in implementing this kind of option in the country.

In summary, although there are important advances in initiatives related to climate change there is still a lot of work to be done, especially in communicating climate change impacts and adaptation alternatives and also providing capacity to professionals working in the public and private sectors, this topic remaining highly in the academy sector.

The following figure presents the results obtained from the stakeholder interviews, focusing on the adequacy of the categories in Spain.

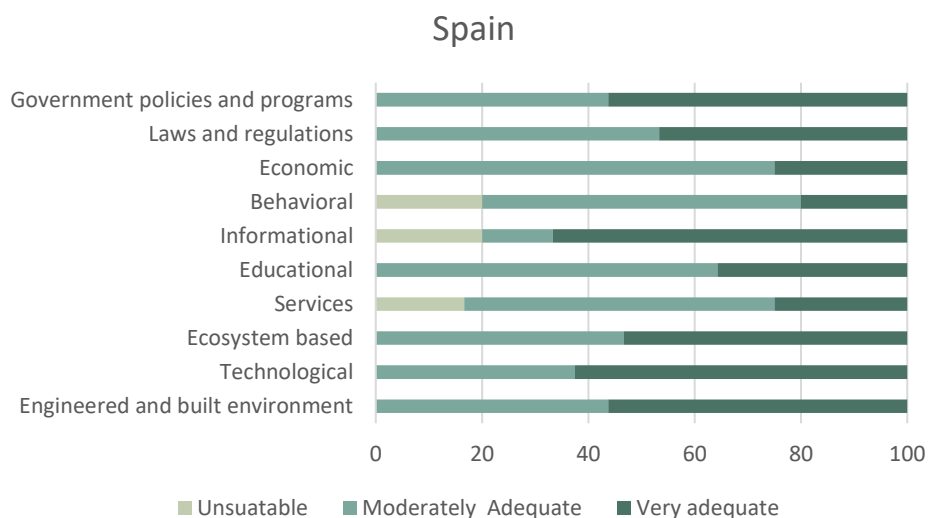


Figure 5. Adequacy of categories of climate change adaptation options in Spain, according to stakeholders’ views.

5.2. Sri Lanka

This analysis was based on five categories, including the national and local governments, civil and professional associations, academia, the community, and the private sector. Responses from 31 respondents were included in this summary. Figure 6 below is a visual presentation of the interview responses. Informational, laws and regulations, and government policies and program categories were identified as very adequate within the Sri Lankan context. Considering the informational category, most respondents confirmed that the informational category is very adequate since no common data-sharing mechanisms exist in Sri Lanka. Also, it was revealed that improvements should be made to provide real-time flood forecasts, hazard mapping, and a platform for storing climate data that is routinely updated to conduct built environment-related projects.

In terms of the laws and regulations applicable to the Sri Lankan context, there is a gap in construction codes related to climate change. Further, the absence of a Climate Act has caused the limited implementation of adaptation measures while existing laws and regulations are also not well practised. In addition, the laws that support research activities of government agencies such as the Irrigation Department or Meteorology Department and universities are absent in Sri Lanka. Collaboration between universities and authorities is also required. For example, Sri Lanka does not have groundwater quality standards although it does have surface water quality standards. Also, there is no baseline for studying the quality of groundwater. Therefore, Sri Lanka should implement such rules and regulations which are crucial.

Concerning the 'government policies and programmes' category, there is a challenge regarding the implementation of the items listed in various country reports. Considering the Sri Lankan context, government policies and programs depict the political will to implement adaptation measures. Sri Lanka has different kinds of policies and programmes that can be applied to climate change adaptation, though they are not implemented. Therefore, having a mechanism to implement those measures is very adequate. In addition to that existing government policies and programmes should be updated.

In the present context, most adaptation measures are related to engineering solutions and new technologies. Therefore, categories such as engineering and built environment, and technology are very adequate. However, respondents mentioned that Sri Lanka has a problem achieving such categories due to the cost of these adaptation categories as the current economic crisis would worsen the problem. Further, as Sri Lanka is a country with rich ecosystems across and around the country, the 'ecosystems category' is also very adequate. Considering the education category, some respondents mentioned that climate adaptation and mitigation education should be initiated at the school level and especially since primary education. Also, respondents mentioned that climate change should be a great concern within tertiary education also. Therefore, having good education would enhance the knowledge of citizens.

According to the validation results, most respondents accepted that all categories are adequate. An important fact that respondents highlighted is that projects should be contextualized to the local phenomenon when implemented under these categories and when taking examples from international contexts. If not, it would be a failure.

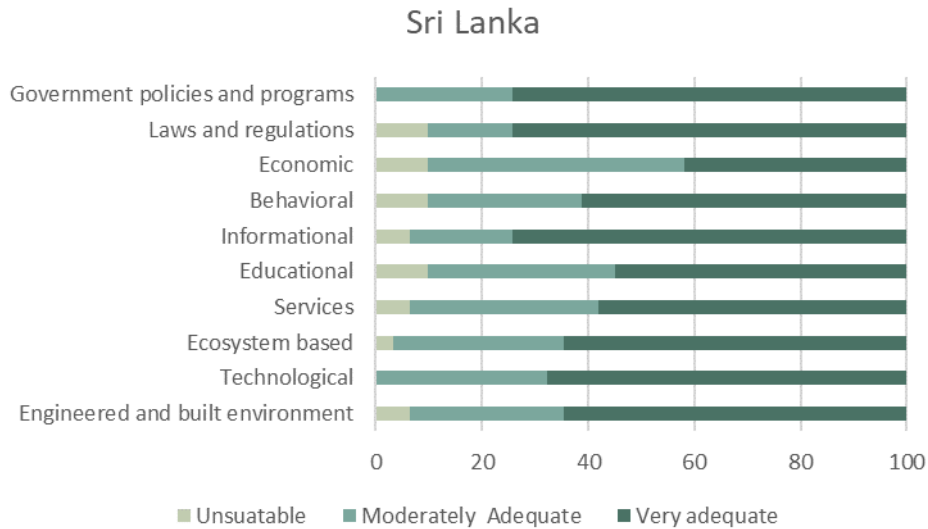


Figure 6. Adequacy of categories of climate change adaptation options in Sri Lanka, according to stakeholders' views.

5.3. Sweden

Climate adaptation measures that were favoured by the interviewees have mostly to do with one of two broader categories, either technical engineering solutions or collaboration efforts. In the former category, there are solutions such as changing surfaces to permeable to deal with rainwater (Malmö/Lund), building walls to protect from flooding (Uddevalla), or building recreational spaces that are also working as 'delay dams' (i.e. Getinge in Halland). In the latter category, there are fewer examples, something that interviewees highlighted as well, but a few success stories, especially climate adaptation network (Gothenburg) and Regional coastal collaboration (Skåne).

Besides the obvious impact, these adaptation measures had/has they also revealed some key strategies when working with adaptation. In Uddevalla, the project is about building a wall to protect from floods, but they focused on more creative ways of involving the public into this process. They did so through artists visualizing how Uddevalla could look in the future and embracing the public opinions on this. Such a way of working creates ownership of the problem, and solution, and is, therefore, more likely to succeed over time.

In Malmö/Lund, they revealed a multitude of small-scale actions that can be taken by individuals to reduce the stress of the citywide sewage system. They did so through, seminars, funding of certain measures, information campaigns, etc. One of the key outputs of this project is to change people perception on who is responsible for water management in the city, and to change people's behaviour and view of water.

Beyond these two most popular categories, there are software tools that many, if not all, climate adaptation officers work with daily. These are not adaptation measures themselves but are in many cases prerequisites for successful adaptation strategies. The software programs most utilized seem to be Geographic Information Systems (GIS), Scalgo, Green area factor as a planning tool, and other mapping tools. In Sweden, these systems are key for consultants, which probably is the key group for developing material, forecasts, and possible solutions that public admin workers or politicians then utilize to adapt to climate change.

There is also work with nature-based solutions (NbS) in a few places in Sweden. One EU Life project takes place in Skåne along the coast. This is a pilot project with NbS which seems possible to do in Sweden. Although, one interviewee with insight complained about the financing regulations which makes NbS less attractive. NbS is currently not the most suitable adaptation strategy, not because it does not work, but because the system favours more engineering ‘hard’ solutions. This makes NbS more expensive and difficult to argue for.

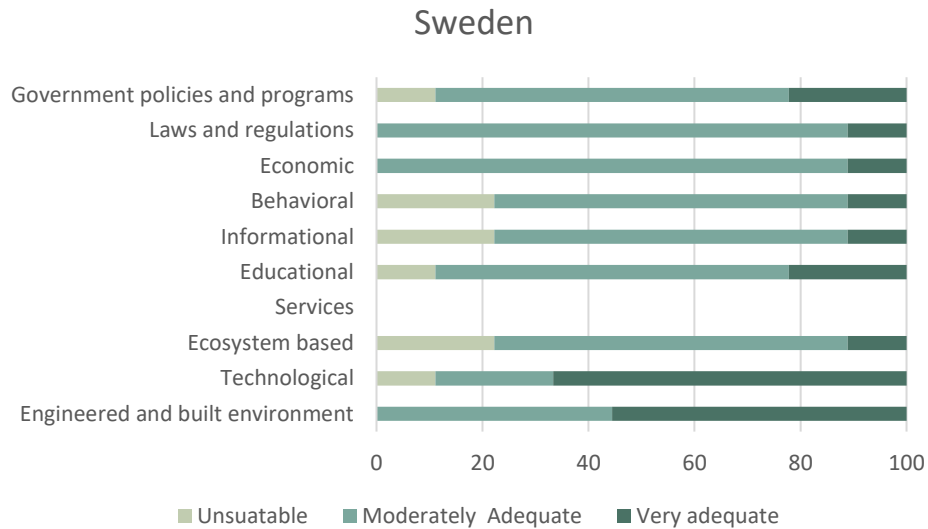


Figure 7. Adequacy of categories of climate change adaptation options in Sweden, according to stakeholders' views.

5.4. United Kingdom

Quantifying current and future climate risks locally is a severe need in the UK. Especially with the year 2021 experiencing both climate extremes in the heat and cold seasons. The transport and power infrastructure planning and operations need to consider the unanticipated weather extremes in the UK.

In designing comprehensive climate change adaptation plans as a country, the UK has been a pioneer in many areas. This is evident in each sector's adaptation plans and strategies concerning climate action.

Applying an adaptive management approach has been highlighted as necessary by the different stakeholders. Especially with the inherent uncertainties and their cascading effects, the need to establish baselines, use flexibility as a crucial success factor, and evaluate the underlying assumptions in a given scenario is a must when evaluating adaptation measures for tackling climate risks. Additionally, adaptation spans multiple scales and sectors. Although climate change adaptation tends to be a local process, higher levels often monitor its progress across numerous portfolios. Therefore, applying an adaptive management approach is relevant in developing and implementing successful climate change adaptation plans in the UK context.

Capitalizing on previous efforts and initiatives is another essential top tip agreed by several stakeholders in the UK. Furthermore, the insufficient understanding of the economic aspects of the adaptation measures acts as a barrier to capitalizing on the previous and current initiatives in the areas. Involving local agencies, planning authorities and the local community in the local adaptation process is essential because although climate change is global climate change adaptation is very much local. Therefore, it is imperative to understand adaptation from the

perspective of the people who are integrating climate change risks and adaptation issues into their day-to-day decisions. Also, exploring the innovative funding mechanisms to use in the climate change adaptation programs is very timely. Despite the extensive national adaptation plans and detailed execution plans in all individual sectors, lack of funding or financial constraints has been identified as a pertaining issue in all recent evidence.

Regarding the coastal complexities, addressing climate change in the UK's coastal regions becomes challenging for several reasons. First, coastal erosion has a significant threat to coastal properties as well as local businesses. Destruction of natural habitats, ecosystems and local farming and agricultural land, loss of archaeologically valuable sites, and damage to coastal infrastructure all link to the deterioration of the coastal economy. Accordingly, analyzing the key inputs from the stakeholders and the current evidence action on climate change adaptation needs to accommodate improved communication of risks and impacts, more adaptive and flexible local institutions with improved capacities and better facilities and provide targeted support for the most vulnerable communities at risk.

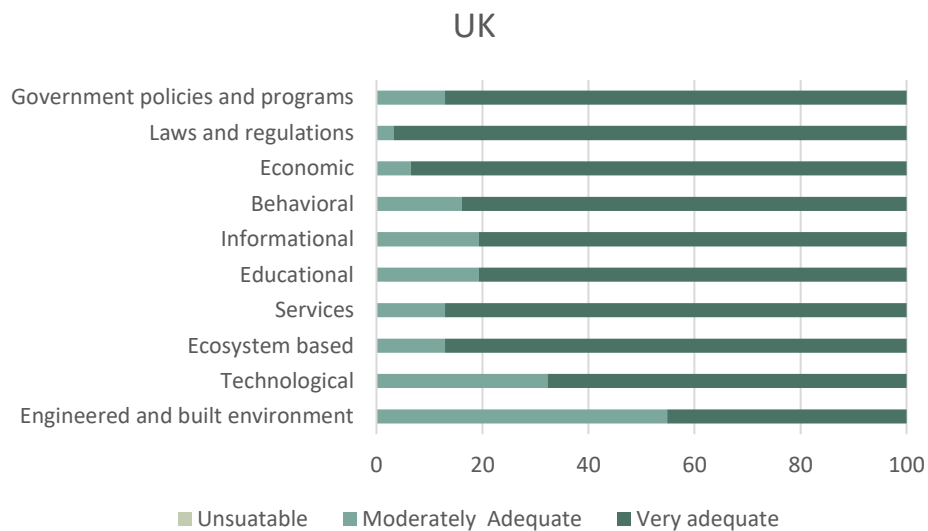


Figure 8. . Adequacy of categories of climate change adaptation options in the UK, according to stakeholders' views.

5.1. Malta

Coastal Engineering was identified as a key area basically in view of the vulnerability of the Maltese Islands as a small island nation with a sensitive and complex cost, presenting a dynamic landscape with conflicting land uses. Climate adaptation measures in coastal areas were in general deemed more critical for the Maltese Islands. In this context major works have been developed by the Infrastructure Malta responsible for the main infrastructure works in Malta. Such works include the upgrading of port facilities where interviewees indicated reference to climate change adaptation, sea level rise and durable structures for future scenarios relying of durable reinforced concrete for the required exposure classes).

Storm water infrastructure was also considered as key in the management and harvesting of water. Such infrastructure includes the major flood relieve project in Malta with underground

tunnels to relieve flooding from low lying flood prone areas in Malta (referenced in one of the Malta tam’s case studies – Output O5).

Training and skills was identified as a major area for action by different stakeholders. In particular reference was made to the two main educational institutions in Malta and other private institutions. The following activities were highlighted as providing an important contribution:

Decarbonisation of the Construction Industry Course

Continuous Development Course for Engineers, Architects, EPC Auditors, Building Industry Stakeholders

Course organised in multiple sessions, in person and online, during the period 2021 – to date, by the Building Industry Consultative Council.

CESBA e learning platform – Sustainable Med Cities

Two courses are offered according to the identified target groups and the two scales, building and urban. All training material is available in English and in other 5 languages (Italian, Spanish, French, Greek, Croatian).

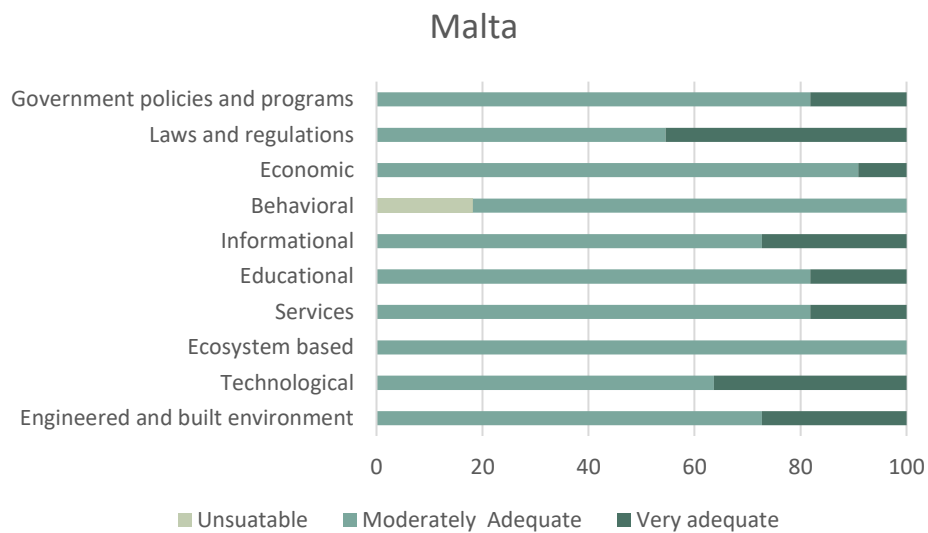


Figure 9. Adequacy of categories of climate change adaptation options in the Malta, according to stakeholders’ views.

6. References

Abeling, T. J. E. H., & Sustainability. (2015). According to plan? Disaster risk knowledge and organizational responses to heat wave risk in London, UK. *1*(3), 1-8.

Adaptation Fund (2022). *Build resilience to climate change and climate variability of vulnerable communities in Mullaitivu District of Sri Lanka*. Adaptation Fund. Retrieved December 8, 2022, from <https://www.adaptation-fund.org/project/build-resilience-to-climate-change-and-climate-variability-of-vulnerable-communities-in-mullaitivu-district-of-sri-lanka/>

AlHinaï, Y. S. J. I. J. o. D. R. R. (2020). Disaster management digitally transformed: Exploring the impact and key determinants from the UK national disaster management experience. *51*, 101851.

Bolton, L. (2020). The Build Back Better Agenda and COVID-19.

Bosher, L., Dainty, A., Carrillo, P., Glass And, J., Price, A. J. B. r., & information. (2007). Integrating disaster risk management into construction: a UK perspective. *35*(2), 163-177.

Boverket. (2011). 'Klimatanpassning i byggande och planering – analys, åtgärder och exempel' Retrieved from: <https://www.boverket.se/globalassets/publikationer/dokument/2011/klimatanpassning-i-planering-och-byggande-webb.pdf> [retrieved 12-11-2022]

BPF. (2021). Goal #9 – Industry, Innovation and Infrastructure.

Brown, J. D., & Damery, S. L. J. T. o. t. i. o. B. G. (2002). Managing flood risk in the UK: towards an integration of social and technical perspectives. *27*(4), 412-426.

CCC. (2018). Managing the coast in a changing climate. Retrieved from

Central Environmental Authority (2022). EIA guidelines. Retrieved December 8, 2022, from <http://www.cea.lk/web/eia-guidelines>

Ceylon Electricity Board (2013). *Ceylon Electricity Board Long Term Generation Expansion Plan*. Docslib. Retrieved December 8, 2022, from <https://docslib.org/doc/1730156/ceylon-electricity-board-long-term-generation-expansion-plan>

Climate Change Committee (2020), "The UK Climate Change Act", CCC Insights Briefings, No. 1 – <https://www.theccc.org.uk/wp-content/uploads/2020/10/CCC-Insights-Briefing-1-The-UK-Climate-Change-Act.pdf>.

Climate Change Secretariat (2010). *Sector vulnerability profile: Agriculture and fisheries - climate change*. Climate Change Secretariat. Retrieved December 10, 2022, from http://www.climatechange.lk/adaptation/Files/Agriculture_and_Fisheries_SVP_Nov-16-2010.pdf

Climate change secretariat (2016a). *Publications*. Climate change secretariat. Retrieved December 10, 2022, from http://climatechange.lk/SNC/Final_Reports/SNC_Final_Report/SNC.pdf

Climate Change Secretariat (2016b). *National Adaptation Plan*. NAP. Retrieved December 12, 2022, from http://www.climatechange.lk/Index_NAP.html

Climate Change Secretariat (2020). *Namas Sri Lanka*. Sri Lanka Nationally Appropriate Mitigation Actions. Retrieved December 10, 2022, from <http://www.climatechange.lk/nama/>

Climate Change Secretariat (2022). *Download documents/publications*. Climate Change Secretariat Sri Lanka. Retrieved December 10, 2022, from <https://climatechange.gov.lk/national-policy-on-climate-change/>

Climate Technology Centre & Network (2022). *Active technical assistance*. Active Technical Assistance | Climate Technology Centre & Network. Retrieved December 12, 2022, from https://www.ctc-n.org/technical-assistance/data?f%5B0%5D=ta_page_countries_ref_facets%3A25121

Coast Conservation Act No. 57 of 1981 (SL). Retrieved from <http://citizenslanka.org/wp-content/uploads/2016/02/Coast-Conservation-Act-No-57-of-1981-E.pdf>

Dawson, R., 2007: Re-engineering cities: a framework for adaptation to global change. *Philosophical Transactions of the Royal Society A*, 365(1861), 3085-3098.

de la Vega-Leinert, A. C., & Nicholls, R. J. J. o. C. R. (2008). Potential implications of sea-level rise for Great Britain. *24*(2), 342-357.

Deeming, H. (2017). Disaster Risk Reduction and the Sendai Framework.

DENTONS. (2022). The UK's approach to climate change – and how the construction industry can help achieve net zero targets: an overview. Retrieved from <https://www.dentons.com/en/insights/articles/2021/october/29/the-uk-s-approach-to-climate-change>

Dias, N., Amaratunga, D., & Haigh, R. (2018). Challenges associated with integrating CCA and DRR in the UK- A review on the existing legal and policy background. *Procedia Engineering*, 212, 978-985. doi:<https://doi.org/10.1016/j.proeng.2018.01.126>

Disaster Management Act No. 13 of 2005 (SL). Retrieved from http://www.unlocked.lk/wp-content/uploads/2019/06/Disaster-Management-Act_E.pdf

Environmental Law Alliance Worldwide (2015). *National Environment Act*. ELAW. Retrieved December 12, 2022, from <http://elaw.org/system/files/National+Environmental+Act+of+1980.pdf>

ESCAMP (2022). *Forestry sector master plan*. Forestry sector master plan | escamp. Retrieved December 12, 2022, from <https://www.escamp.lk/forestry-master-plan/>

European Union. (2007). 'DIRECTIVE 2007/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL'. Retrieved from: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007L0060&from=SV> [retrieved 12-11-2022]

Fauna and Flora Protection (Amendment) Act No. 22 OF 2009 (SL). Retrieved from https://stepbysteptrade.lk/media/ordinanceeng_1.pdf

Global Environment Facility (2022). *Promoting sustainable biomass energy production and modern Bio-Energy Technologies*. Global Environment Facility. Retrieved December 8, 2022, from <https://www.thegef.org/projects-operations/projects/4096>

González, A., Gabàs, A., Cardoso, M.A., Brito, R.S., Pereira, C., Russo, B., Martínez, M., Velasco, M., Domínguez, J.L., Sánchez-Muñoz, D., Pardo, M., Monjo, R., Martínez, E., Guerrero, M., Forero, E., Pagani, G., Fourniere, H., Locatelli, L. (2020). Barcelona Resilience Action Plan. In Resilience Action Plans of the RESCCUE cities. D6.2 RESCCUE project (Public).

GOV.UK. (2011). Climate Resilient Infrastructure: Preparing for a Changing Climate Retrieved from

GOV.UK. (2016). Guidance: Community resilience framework for practitioners.

GOV.UK. (2019). Voluntary National Review of progress towards the Sustainable Development Goals. Retrieved from

GOV.UK. (2020). The ten point plan for a green industrial revolution. In: H.M. Government London, UK.

GOV.UK. (2021). Build Back Better: our plan for growth. Retrieved from

Green Climate Fund. (2019). *Sri Lanka*. Green Climate Fund. Retrieved December 8, 2022, from <https://www.greenclimate.fund/countries/sri-lanka>

Guido (2022). *Sri Lanka and ADB*. Asian Development Bank. Retrieved December 8, 2022, from <https://www.adb.org/countries/sri-lanka/main#projects>

Hemingway, R., & Gunawan, O. J. I. j. o. d. r. r. (2018). The Natural Hazards Partnership: A public-sector collaboration across the UK for natural hazard disaster risk reduction. 27, 499-511.

Hesselman, M. (2019). *Access to disaster risk information, early warning and education: Implementing the Sendai framework through human rights law*. Paper presented at the Disaster Risk Reduction in International Law Symposium, University of Reading/Walker Institute, UK-29 June-31 July 2017.

ICAI. (2018). Building resilience to natural disasters A performance review. London

International Finance Corporation (2022). *IFC PROJECT INFORMATION & DATA PORTAL*. International Finance Corporation-World Bank Group. Retrieved December 8, 2022, from https://disclosures.ifc.org/enterprise-search-results-home?f_region_description=SARREG

Kim, H. J. D. (2014). Learning from UK disaster exercises: policy implications for effective emergency preparedness. 38(4), 846-857.

Klimatanpassning.se. (no year). Retrieved from: <https://www.klimatanpassning.se/klimatanpassa> [retrieved 12-11-2022]

Land Use Policy Planning Department (2022). *National Land Use Policy of Sri Lanka*. Land Use Policy Planning Department. Retrieved December 8, 2022, from https://luppd.gov.lk/images/content_image/downloads/pdf/national_land_use_policy.pdf

MAPAMA, 2014: Cambio climático en a costa española. Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente.

MAPAMA, 2016. Estrategia de adaptación al cambio climático de la costa española. Dirección General de Sostenibilidad de la Costa y del Mar, Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente. Madrid. 120 pág.

Ministerio de Medio Ambiente (2007). Estrategia Española de Cambio Climático y Energía Limpia, Horizonte 2007-2012-2020.

Ministerio para la Transición Ecológica y el Reto Demográfico (MITECO) (2006). Plan Nacional de Adaptación al Cambio Climático 2006-2020.

Ministerio para la Transición Ecológica y el Reto Demográfico. (2023) PIMA Adapta. <https://www.miteco.gob.es/es/cambio-climatico/planes-y-estrategias/PIMA-Adapta.aspx> [Last access: 01/2023]

Ministry of Environment (2020). *National policy on waste management*. Ministry of Environment. Retrieved December 15, 2022, from http://www.env.gov.lk/web/images/pdf/policies/National_Policy_on_Waste_Management_English.pdf

Ministry of Environment-Sri Lanka (2021). *National Environmental Policy and Strategies*.

Ministry of Environment-Sri Lanka (2022). Retrieved December 15, 2022, from http://www.env.gov.lk/web/images/downloads/policies/national_environmental_policy_2003.pdf

Myndigheten för samhällsskydd och beredskap (no year) 'Statsbidrag för naturolyckor' Retrieved from: <https://www.msb.se/sv/amnesomraden/skydd-mot-olyckor-och-farliga-amnen/naturolyckor-och-klimat/statsbidrag-vid-naturolyckor/> [retrieved 05-11-2022]

Myndigheten för Samhällsskydd och Beredskap. (no year). 'Översvämningssportalen' Retrieved from: <https://gisapp.msb.se/Apps/oversvamningsportal/index.html> [retrieved 12-11-2022]

NAMA Design Document for Transport Sector of Sri Lanka DRAFT. (2015). <http://www.climatechange.lk/NAMAs/SL%20Transport%20Sector%20NAMA-Semi%20Final.pdf>

National Environment Act No. 47 of 1980 (SL). Retrieved from <https://www.elaw.org/system/files/National+Environmental+Act+of+1980.pdf>

O'Brien, G., O'keefe, P., Rose, J., & Wisner, B. J. D. (2006). Climate change and disaster management. *30*(1), 64-80.

OECD (2022, forthcoming), OECD Environmental Performance Reviews: the United Kingdom 2022, OECD Environmental Performance Reviews, OECD Publishing, Paris.

Prabhakar, S., Srinivasan, A., Shaw, R. J. M., & change, a. s. f. g. (2009). Climate change and local level disaster risk reduction planning: need, opportunities and challenges. *14*(1), 7-33.

PWC. (2013). Stimulating private sector engagement and investment in building disaster resilience and climate change adaptation. Retrieved from

Regeringskansliet (1998) (Förordning 1998:808) Retrieved from: <https://rkrattsbaser.gov.se/sfst?bet=1998:808> [retrieved 04-11-2022]

Regeringskansliet (2010) (Förordning 2010:900) Retrieved from: <https://rkrattsbaser.gov.se/sfst?bet=2010:900> [retrieved 04-11-2022]

Regeringskansliet (2018) (Förordning 2018:1428) Retrieved from: <https://rkrattsbaser.gov.se/sfst?bet=2018:1428> [retrieved 04-11-2022]

Zoer, V., Surminski, S., Laurien, F., McQuistan, C., & Mechler, R. (2021). Multiple resilience dividends at the community level: A comparative study on disaster risk reduction interventions in different countries.

Saha, A. K., Al-Shaer, H., Dixon, R., & Demirag, I. J. A. A. R. (2021). Determinants of carbon emission disclosures and U.N. sustainable development goals: the case of UK higher education institutions. *31(2)*, 79-107.

Schultze, L., Keskitalo, C., Bohman, I., Johansson, R., Kjellström, E., Larsson, H., Lindgren, E., Storbjörk, S., Vulturius, G. (2022) 'Första rapporten från Nationella expertrådet för klimatanpassning'.

Solimar International (2022). *USAID Climate Adaptation Project in the Maldives & Sri Lanka*. Solimar International. Retrieved December 15, 2022, from <https://www.solimarinternational.com/project/usaids-climate-adaptation-project/>

Sri Lanka Land Reclamation and Development Corporation Act No. 52 of 1982 (SL). Retrieved from <https://www.lawnet.gov.lk/sri-lanka-land-reclamation-and-development-corporation-2/>

Svenskt vatten. (2020). 'Rekommendationer vid val av nederbördsstatistik för dimensionering av dagvattensystem'. Retrieved from: https://www.svensktvatten.se/globalassets/rornat-och-klimat/klimat-och-dagvatten/svensktvatten_smhi_pm-april-2020.pdf [retrieved 12-11-2022]

The Soil Conservation Act No.25 of 1951 (SL). Retrieved from <https://www.lawnet.gov.lk/soil-conservation-3/>

UKGBC. (2021). Whole Life Carbon Net Zero Roadmap :A Pathway to Net Zero for the UK Built Environment.

UKGBC. (2022). UKGBC's vision for a sustainable built environment is one that mitigates and adapts to climate change. *UK Green Building Council*.

UKRI. (2022). Infrastructure investments to boost UK research and innovation.

UN (2022). *Air Quality Policies in Sri Lanka*. UNEP. Retrieved December 11, 2022, from <https://www.unep.org/resources/policy-and-strategy/air-quality-policies-sri-lanka>

UN World Food Programme (2022). *SAVING LIVES CHANGING LIVES*. UN World Food Programme. Retrieved December 11, 2022, from <https://www.wfp.org/publications?f%5B0%5D=country%3A2086&f%5B1%5D=topics%3A2140>

UNISDR. (2015). The Sendai Framework for Disaster Risk Reduction: the challenge for science. Retrieved from

Unit, B. (2022). *Latest nbsap??s*. Convention on Biological Diversity. Retrieved December 11, 2022, from <https://www.cbd.int/nbsap/about/latest/#lk>

United Nations (2022). *The 17 goals | sustainable development*. United Nations. Retrieved December 11, 2022, from <https://sdgs.un.org/goals>

United Nations Environment Programme (UNEP), 2014. UNEP Environmental Data Explorer, compiled from UNEP/DEWA/GRID-Geneva. UNEP, Geneva.

UN-REDD PROGRAMME (2022). *National Redd+ Investment Framework and Action Plan (NRIFAP)* - *un-redd.org*. UN-REDD PROGRAMME. Retrieved December 15, 2022, from https://www.un-redd.org/sites/default/files/2021-10/NRIFAP%202018-2022_English_chapter_1_5%20%28961894%29.pdf

Urban Development Authority (Amendment) Act No. 49 of 1987(SL). Retrieved from <https://www.lawnet.gov.lk/urban-development-authority-3/>

Vizzuality (2022a). *Coastal Zone and Coastal Resource Management Plan 2018*. Sri Lanka - Climate Change Laws of the World. Retrieved December 11, 2022, from <https://www.climate-laws.org/geographies/sri-lanka/policies/coastal-zone-and-coastal-resource-management-plan-2018>

Vizzuality (2022b). *Technology needs assessment and technology action plans for climate change mitigation*. Sri Lanka - Climate Change Laws of the World. Retrieved December 11, 2022, from <https://www.climate-laws.org/geographies/sri-lanka/policies/technology-needs-assessment-and-technology-action-plans-for-climate-change-mitigation>

Von Bahr, Emelie., Ivarsson, Mats. (2020) 'Finansieringsmodeller för klimatanpassningsåtgärder'. COWI, Göteborg. Retrieved from: http://projects.swedgeo.se/RKS-SH/wp-content/uploads/2020/06/Finansieringsmodeller_for_klimatanpassning_slutversion_20200604.pdf [retrieved 05-11-2022]

World Bank (2022). *Projects*. World Bank. Retrieved December 15, 2022, from https://projects.worldbank.org/en/projects-operations/projects-list?countrycode_exact=LK&countryshortname_exact=Sri+Lanka&strdate=01-02-2018&os=0&enddate=11-15-2022

World Meteorological Organization (2021). *Manuals-Guides-Technical Regulations | World Meteorological Organization*. World Meteorological Organization. Retrieved December 15, 2022, from <https://community.wmo.int/manuals-guides-technical-regulations>

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