



Nordic Council
of Ministers

Comparison and analysis of national climate change adaptation policies in the Nordic region

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Executive summary

This report presents the findings from a comparative study of climate change adaptation policy in Denmark, Finland, Iceland, Norway, and Sweden. The report is commissioned by the Nordic Working Group for Environment and Economy (NME) and the Nordic Working Group for Climate and Air (NKL) under the Nordic Council of Ministers. The tender called for a comparative analysis of the adaptation policy landscape, including legislative framework, policy instruments and analytical approaches as well as financing mechanisms in the Nordic countries, with the aim of identifying differences, similarities, best practices as well as any key factors influencing the progress of national adaptation.

Based on document analysis and adaptation expert interviews, this report presents a mapping and comparison between the five Nordic countries and identifies the path forward for adaptation to not only be effective and viable but support sustainable societal development in the Nordic region and beyond.

The main findings of the report are the following:

- The Nordic countries have come a long way in developing policies that enable them to assess climate change-related risks and vulnerabilities across sectors and geographies and identify and implement adaptation measures, and most countries have completed at least one adaptation policy planning cycle. Yet, the lack of comprehensive systems for conducting risk and vulnerability assessments and for monitoring, reporting, and evaluating progress means that the Nordic countries are largely operating “in the dark” when it comes to furthering climate change adaptation nationally and locally. This is especially the case with transboundary climate risks, which is a policy area of growing concern, but which currently lacks systematic policy initiatives.
- The Nordic countries generally take a mainstreaming approach to adaptation, meaning that adaptation is integrated into the responsibilities of public bodies across societal sectors. In addition, some countries have a ministry with the overarching responsibility for coordinating adaptation efforts nationally. Yet, adaptation is marked by low political priority across all the Nordic countries, which shows both in the political mandate of the coordinating ministry as well as a low level of funding for adaptation, especially when seen in comparison with mitigation.
- There is a lack of policy instruments on adaptation across the Nordic countries. Most notably, there is a significant gap in the existence of economic measures to support and incentivize adaptation nationally and locally. While some funding and insurance schemes exist, these do little to

incentivize proactive adaptation, especially for private sector and individual citizens. None of the Nordic countries have penalizing measures, such as taxes.

- There is a growing awareness among both public authorities and adaptation practitioners of the importance of ensuring that adaptation is coordinated with other related policy areas, such as mitigation, civil protection, and the Sustainable Development Goals. Yet, in practice, adaptation is still largely worked with in isolation, which increases the risk of goal conflicts and misses the potential for synergy.

Based on these findings, the report offers the following policy recommendations for the Nordic governments:

- Reframe adaptation as transformation and support the alignment of adaptation with other societal goals.
- Establish mechanisms for systematic knowledge generation and develop appropriate indicators for measuring and evaluating adaptation, including for transboundary climate risks.
- Break down silo-structure between sectors and develop a clearly articulated policy cycle.
- Enhance adaptation financing and economic incentive mechanisms and translate knowledge on risks and vulnerabilities to local adaptation measures.
- Enhance the political mandate for adaptation and strengthen international commitments, including through Nordic collaboration.

Along with a recently published report on transboundary climate risks in the Nordic countries (Berninger et al. 2022), the present report supports enhanced knowledge sharing and collaboration between the Nordic countries in terms of adaptation policy.

Sammendrag

Denne rapport præsenterer resultaterne fra en komparativ kortlægning af klimatilpasningspolitikken i Danmark, Finland, Island, Norge og Sverige. Rapporten er bestilt af den nordiske arbejdsgruppe for miljø og økonomi (NME) og den nordiske arbejdsgruppe for klima og luft (NKL) under Nordisk Ministerråd. Opgaven bestod i en komparativ analyse af det tilpasningspolitiske landskab, herunder lovgivningsmæssige rammer, politiske instrumenter og analytiske tilgange samt finansieringsmekanismer i de nordiske lande, med det formål at identificere forskelle, ligheder, bedst praksis samt eventuelle nøglefaktorer, der påvirker udviklingen af national klimatilpasning. Den komparative kortlægning baserer sig på dokumentanalyse og interview med tilpasningsekspertter i de fem lande. På baggrund af kortlægningen peger rapporten på vejen videre indenfor klimatilpasning, med særligt fokus på at tilpasningspolitikken ikke blot skal være effektiv og vedvarende, men også bidrage til bæredygtig samfundsudvikling i såvel som udenfor Norden.

De vigtigste resultater fra rapporten kan opsummeres således:

- De nordiske lande er nået langt med at udvikle policy, der gør dem i stand til at vurdere klimarelaterede risici og sårbarheder på tværs af sektorer og geografi og identificere og implementere tilpasningstiltag, og de fleste lande har gennemført mindst én tilpasningspolitisk planlægningscyklus. Manglen på omfattende systemer til at udføre risiko- og sårbarhedsvurderinger og til overvågning, rapportering og evaluering af fremskridt, betyder imidlertid at de nordiske lande i høj grad opererer "i blide", når det kommer til at fremme klimatilpasning nationalt og lokalt. Det er især tilfældet med grænseoverskridende klimarisiko, som er et politikområde med stigende relevans, men som i dag mangler systematiske politiske initiativer.
- De nordiske lande har generelt en mainstreaming tilgang til tilpasning. Dette betyder at tilpasning er en del af det eksisterende ansvar som offentlige instanser har. Derudover har nogle lande et ministerium med det overordnede ansvar for at koordinere tilpasningsindsatsen nationalt. Alligevel er tilpasning præget af lav politisk prioritet på tværs af alle de nordiske lande, hvilket viser sig både ved det koordinerende ministeriums relativt lave politiske mandat, samt underfinansiering af klimatilpasning, især set i forhold til CO₂-reduktion.
- Der mangler politiske virkemidler knyttet til tilpasning. Der er særligt mangel på økonomiske virkemidler, som giver incitament til tilpasning, både nationalt og lokalt. Der findes nogle finansierings- og forsikringsordninger i de fleste

nordiske lande, men disse ordninger giver ikke incitament til proaktiv tilpasning. Der mangler særlig incitament rettet mod erhvervslivet og individuelle borgere. Ingen af de nordiske lande har økonomiske virkemidler som har til formål at overvåge og sanktionere manglende tilpasning, såsom skatter og afgifter.

- Der er en voksende bevidsthed blandt både offentlige myndigheder og praktikere om, hvor vigtigt det er at sikre, at tilpasning er koordineret med andre nærtliggende policy-områder, såsom CO₂-reduktion, civilt beredskab og FN's bæredygtighedsmål. Alligevel er klimatilpasningspolitik og -tiltag i praksis ofte isoleret fra andre relevante arbejdsområder, hvilket øger risikoen for målkonflikter og reducerer muligheden for synergi.

Baseret på disse resultater præsenterer rapporten følgende politiske anbefalinger til de nordiske regeringer:

- Formuler tilpasning som transformation og støt op om muligheden for at tilpasningspolicy og -tiltag kan udvikles og implementeres i sammenhæng med andre relaterede samfundsmål.
- Etabler mekanismer til systematisk videns-produktion og udarbejd relevante indikatorer til brug for måling og evaluering af tilpasning, herunder for grænseoverskridende klimarisiko.
- Nedbryd silostrukturen mellem sektorer og ministerier og etabler en tydelig policy-cyklus.
- Forbedre tilpasningsfinansiering og økonomiske incitament og omsæt viden om klimarisiko og -sårbarhed til lokale tilpasningstiltag.
- Styrk tilpasnings politiske mandat og styrk internationale forpligtelser, bl.a. igennem nordisk samarbejde.

Sammen med en nyligt offentliggjort rapport om grænseoverskridende klimarisiko i de nordiske lande (Berninger et al., 2022) understøtter denne rapport øget videndeling og samarbejde mellem de nordiske lande indenfor klimatilpasning.

Preface

All Nordic countries are experiencing the diverse and increasing impacts of climate change, both nationally and on account of transboundary effects and are working across multiple levels of governance to adapt to a changing climate in ways that enhance their resilience. While there are some similarities in terms of both the impacts experienced and the governance structures used to respond to climate change, the approaches to and experiences with adaptation also vary when it comes to planning, execution, and evaluation of climate change adaptation policies. In the case of adaptation policies, there is a clear potential to learn from each other's knowledge and experiences. The Vision of the Nordic Council of Ministers is to make the Nordic region the most sustainable and integrated region in the world by 2030. Continued research and promotion of solutions that enhance climate adaptation supports this vision.

This report contains an analysis and description of national climate adaptation policies in the Nordic countries. The report was commissioned by the Nordic Working Group on Environment and the Economy in collaboration with the Nordic Working Group on Climate and Air. The report has been prepared by a consortium of researchers representing the following institutions: Western Norway Research Institute in collaboration with Stockholm Environment Institute, University of Helsinki, and the Technical University of Denmark.

The report contains a thorough list of key findings and recommendations. Among the key findings, it is worth mentioning that there seems to be a lack of economic policy instruments which would incentivize adaptation policy measures at the national level. From a Nordic perspective, it is important to note the key role of cooperation and knowledge sharing between the Nordic countries in the adaptation field.

Comments to the report have been provided by a steering group consisting of adaptation experts from the Nordic countries during the preparation of the report. The authors of the report are responsible for the content as well as the assessments and recommendations, which do not necessarily reflect the views and the positions of the governments in the Nordic countries.

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1. Introduction

1.1. The climate change challenge

The impacts of climate change are being felt across the globe, with many impacts experienced earlier and more severely than expected (IPCC, 2022). In Europe as well as in the Nordic countries, the past years have seen several instances of both extreme heat and extreme rainfall, which in many cases exceed the capacity of existing physical and political infrastructures to respond. The imperative to prepare for and adapt to these changes is becoming increasingly clear.

Adaptation has been defined by the Intergovernmental Panel on Climate Change (IPCC) as the process of adjustment to actual or expected climate and its effects in ways that seek to moderate or avoid harm or exploit beneficial opportunities (IPCC, 2022). However, climate change adaptation is not just about adapting to an increasingly challenging climate. In its 2012 special report on managing the risks of extreme events and disasters to advance climate change adaptation, the IPCC states that “some strategies for effectively managing risks and adapting to climate change involve adjustments to current activities. Others require transformation or fundamental change” (IPCC, 2012, p. 4). The report defines **transformation** in the context of climate change adaptation as “the altering of fundamental attributes of a system (including value systems; regulatory, legislative, or bureaucratic regimes; financial institutions; and technological or biological systems)” (Ibid.). In more recent years, adaptation has also been increasingly linked to efforts to protect biodiversity and ensuring just energy transitions, especially through the work of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). In this perspective, climate change adaptation must also be concerned with how to adapt in ways that helps prevent further climate change and helps to address the need for social transformations toward more inclusive and equitable societies (IPBES, 2019).

1.2. Climate change adaptation in the Nordic countries

The Nordic countries have in many respects been considered as front-runners on climate policy (Christensen, 1996; Witoszek and Midttun, 2018). However, according to a 33-country survey conducted by the European Environment Agency (2020), this is not always the case in all Nordic countries when it comes to climate change adaptation. Several studies and evaluations conducted in the different Nordic countries in recent years have concluded that climate change adaptation is happening too slowly, is often aimed at the climate of today as opposed to the climate of tomorrow and lacks the appropriate knowledgebase to estimate how

climate change will affect society and which measures are most effective in preventing unacceptable forms and levels of damage (e.g., Vindegg et al., 2022; Riksrevisionen, 2022).

The Nordic countries share many of the same climate change-related challenges and can also benefit from similar approaches to finding solutions, including ways of adapting successfully to climate change (Berninger et al., 2022). With most of the Nordic countries having completed their first adaptation planning cycle, and some in the process of completing their second cycle, now is a pertinent time to investigate organizational set-ups, lessons learned, challenges and future possibilities. Thus far, there has been little coordinated effort to compare adaptation within the Nordic region.

The Nordic countries are uniquely positioned to take the lead in developing integrated and sustainable approaches for how to tackle climate change in ways that are equitable and just. Situated within some of the oldest and strongest democracies in the world, the Nordic countries can not only *respond* to the challenge of climate change but *realize* the potential for sustainable societal development, including by adopting a more transformative approach to meeting the climate change challenge. The realization of this potential will depend on how the Nordic countries structure and coordinate their adaptation efforts in the years to come. Research suggests that coordinated and integrated approaches to adaptation will be key for such efforts to generate effective and sustainable results (O'Brien et al., 2022).

1.3. Methods and analytical approach

Data and methods

The report is based on document analysis and informant interviews. The document analysis has primarily drawn on national policy documents, such as strategies, government white papers and action plans, covering both cross-sector and sector documents, as well as internal and external progress reports and evaluations. The analysis has been complemented with research literature in the form of project reports and journal articles.

Informant interviews have been conducted for each country to complement and add nuance to the document analysis. Interviews have also informed the evaluation of best practices and challenges within the current adaptation policy landscape. A total of 16 informants from both the national and sub-national level have been interviewed, with 3–4 informants interviewed in each country. The interviewees are kept anonymous.

Analytical approach

The tender called for a comparative analysis of the adaptation policy landscape, including legislative framework, policy instruments and analytical approaches as well as financing mechanisms. We have approached our mapping and comparative analysis through five interrelated themes with guiding questions for each of the themes.

1. Governance structure

- What is the timeline of national adaptation policy development?
- What does the organizational set-up for climate change adaptation nationally look like currently, and what is the assigned policy ownership nationally?
- How is responsibility for adaptation assigned across national, regional, and local levels?
- How is coordination structured across government departments and between national, regional, and local entities?
- What responsibilities and risk ownership are assigned to public sector entities, private sector entities, civil society, and individual citizens?

2. Themes

- What themes are prioritized in adaptation efforts? E.g., damages from natural hazards on physical infrastructure, health-related challenges, impact on biodiversity, impact on primary production, food security, trade, etc.
- What type of climate risk receives most consideration? E.g., trans-boundary climate risks, local physical climate risks.

3. Policy instruments

- What governance structures and policy frameworks guide work on adaptation nationally?
- What additional strategies and plans structure and guide work on adaptation regionally and/or locally?
- What visions, goals and principles are central to these strategies and plans?
- What laws and legislations govern these strategies and plans?
- What systems are in place for monitoring, reporting and evaluating (MRE) the adaptation efforts nationally?
- What is the relationship between MRE across different levels of governance?
- What systems exist for guidance, information sharing and support across

scales (national, regional, local)?

- What type of economic measures exist to incentivise adaptation efforts across scales (national, regional, local) and sectors? These can be divided into three main categories: positive (e.g., subsidy schemes), negative (e.g., taxes) and neutral (e.g., insurance).

4. Knowledge generation

- What themes, societal areas and sectors are most commonly included in national, regional and local risk assessments?
- What evaluations have been made to assess the socio-economic impacts of climate change and the costs and benefits of adaptation measures?
- What evaluations have been made as to transboundary climate risks?

5. Integration

As an additional analytical lens, we pay careful attention to the degree of integration. We understand integration in three distinct ways:

- Integration of adaptation within the existing work of public authorities (i.e., mainstreaming)
- Degree of collaboration and coordination between public bodies on adaptation-related questions
- Degree of alignment between climate change adaptation work and other closely related policy areas, such as GHG-mitigation, disaster risk management and reduction, energy transition, biodiversity protection, and the Sustainable Development Goals (SDGs).

This final focus is derived from the growing recognition that climate change adaptation efforts are more likely to succeed in building resilient and adaptive societies if they are understood and worked with in an integrated way that accounts for both possible synergies and areas of conflict.

Evaluation

In accordance with the tender, the mapping of the above themes leads to a comparative identification of best practices and key progress factors for national climate change adaptation. Due to the lack of official evaluation criteria and indicators in the Nordic countries, we have taken a pragmatic approach and based our assessment of best practices and key challenges on the evaluation work done in each country (e.g., evaluation reports) and the perspectives of the expert informants interviewed. While best practices and key challenges differ somewhat

between countries, most of the issues identified are present across the countries, making it possible to synthesize key issues for the Nordic region.

We have focused our evaluation on the degree to which the national policy landscapes supports the progress of adaptation. We have understood progress to imply enhancing the effectiveness, timeliness, and sustainability of adaptation efforts. This is evaluated through three cross-cutting themes:

- Type and content of current policies, systems, and tools
- Division of responsibility and degree and format of coordination and collaboration
- Degree of integration of adaptation within sectors and across societal challenges

To bring these differing perspectives together in an analysis of potentials for further developing and enhancing adaptation across the Nordic countries, we have framed the last chapter of the report within the notion of *transformational adaptation* and structured the potentials according to four aspirational goals for adaptation: *smarter adaptation, more systemic adaptation, faster adaptation, and more internationally oriented adaptation*. While the notion of transformational adaptation is largely derived from the IPCC (2022), the four aspirational goals are drawn from the EU adaptation strategy (European Commission, 2021) as well as scientific literature on the potential and need for adaptation to align with sustainable development (e.g., Eriksen et al., 2015; O'Brien, 2012).

The EU adaptation strategy has been identified as a relevant document in this regard due to its aspirational character and the EUs position as a leader on adaptation in a European context. Thus, while not all Nordic countries are EU member states, all report on their adaptation efforts as members of the European Environment Agency (EEA), and they are thereby already guided by the structures and priorities of the EU. Both Iceland and Norway are fully integrated in the EU Emission Trading Scheme, while other parts of the climate policy area are not implemented in the agreement. Norway, Iceland, and the EU have formally agreed to cooperate on reducing greenhouse gases according to their national determined contributions under the Paris Agreement. Additionally, with increased awareness of the transboundary nature of climate change, an international outlook on adaptation is likely to increase in coming years, further emphasizing the relevance of the EU perspective.

The suggestions for the way forward for adaptation in the Nordic countries presented in the final chapter of the report have formed the basis for a set of policy recommendations, also published by the Nordic Council of Ministers (<https://pub.norden.org/nord2023-014>).

Limitations

As the process of evaluating climate change adaptation efforts within the Nordic countries is still in an early phase, there is little information available about strengths and weaknesses of various approaches and policies. In some cases, we therefore rely on the perspectives and experiences of our interviewees, who are policy experts within the adaptation field. When possible, we add nuance and back-up interview data with written sources.

While some of the themes of the report are described in great detail within national policy documents and plans, others are less so. In those cases where a theme is neither addressed in key documents nor raised by the interviewees, we have considered it to be an issue that has received little to no attention within the national context. This is especially the case with economic measures for adaptation, which are largely lacking in the Nordic countries.

2. Denmark

2.1. Governance structure

National adaptation policy-landscape

Denmark is a country with low elevations and long coastlines, stretching approx. 8000 km along the Baltic and North Seas while spanning more than 400 islands and the Jutland peninsular. Historically, flooding, coastal erosion, and storm surges have been sources of significant damages and loss of lives within low-lying and coastal areas, and hence Denmark has a long record of building dikes and other protective measures towards these natural hazards. Following repeated occurrences in 2010 and 2011 that caused central parts of Copenhagen to be flooded and threatened critical infrastructure, there has also been a strong focus on cloudbursts and surface flooding, whereas recently also drought, heatwaves and wildfires have received increased attention in Denmark.

The first **National Adaptation Strategy (NAS)** was established by the Danish government in 2008. Until then, adaptation was almost entirely addressed at local levels or within vulnerable sectors. The NAS provided guidance on how the government, local authorities, and businesses should work together to achieve national policy goals for climate change adaptation (Danish government, 2008). The strategy outlined specific goals, measures, and responsibilities for actors in both the public and private sectors. The strategy recognized the need for cross-sectoral collaboration and emphasized the importance of public participation in developing and implementing adaptation measures. Primarily, this implies that (see also the section on responsibilities below and Figure 2.1):

- The Danish government provides the framework for adaptation including technical support and advice to underpin the development of local adaptation plans and their implementation.
- Municipalities are responsible for planning and directing their own adaptation to climate change.
- Landowners, wastewater utilities, local stakeholders, and citizens are responsible for implementing adaptation at the local level. In practice, this sometimes also involves municipalities although the level of engagement differs between municipalities.

As a direct result of the NAS, the national adaptation portal "Klimatilpasning.dk" was established under the Danish Environmental Protection Agency. Also, a scientific coordination unit for research in climate change adaptation was established temporarily with participation from the leading universities and research environments within adaptation in Denmark.

In 2012, the NAS was supplemented by a **National Action Plan (NAP)** for a "climate-proof Denmark" (Danish government, 2012). The NAP is based on the philosophy that responsible climate policies must do more than just work towards limiting the adverse impacts of climate change in the long term. It should also ensure adaptation to a climate that is already changing, and that all parts of society should contribute. The NAP affirms that: "Climate change adaptation is first and foremost locally based – at the municipalities, authorities, companies or individuals". Hence the role of the Danish government is to establish the regulatory framework for local climate change adaptation by adapting laws and regulations, ensuring coordination, and providing information. Main elements in this regard include the Planning Act, Floods Act, the Act on Water Courses, the Water Supply Act, and the Environmental Act. Following the NAP's publication, the current government and the municipalities agreed that the latter would increase investments in adaptation, and that all municipalities would carry out a risk assessment and prepare municipal climate change adaptation plans, supported by a task force established by the Ministry of Environment (Government and Local Government Denmark, 2013). All 98 Danish municipalities had finished their plans in 2014. There were no formal requirements with respect to future revisions, and hence adaptation was not generally integrated into the municipal policy cycles.

The revised **Planning Act** of 2018 (Ministry of the Interior and Health of Denmark, 2020). is one of the most important documents for adaptation in Denmark (Interviews, Denmark). Under these revisions, municipalities became legally obliged to consider flooding and coastal erosion in their physical planning. Coastal erosion was not previously part of the municipal adaptation plans. As per the Planning Act it is compulsory to introduce mitigation or remedial measures if planned areas are found to be exposed to flooding or erosion. Over the following three years, the Danish Housing and Planning Authority have introduced and gradually updated official guidelines to ensure fulfilling these changes, i.e., guidelines on how to plan and adapt against flood and erosion risk in accordance with the Planning Act. This was done to accommodate the emergence of improved data, with the latest version introduced in 2022 (Danish Housing and Planning Authority, 2022).

The Climate Act of 2019 is the first overarching and legally binding document on climate change in Denmark. It sets a legally binding target for the country to reduce its greenhouse gas emissions by 70% by 2030 compared to the 1990 levels and to become a net-zero society by 2050 (Danish Government, 2019). The net-zero target has been brought forward to 2045 by the government elected in 2022. So far, the

revised net-zero target is only stated in the government platform, and it is not yet adopted in a legally binding form. The Climate Act establishes an independent Climate Council to provide expert advice and monitor progress towards these targets and requires the Danish government to develop regular climate action plans. Neither the Climate Act nor the Climate Council concerns adaptation.

The new **Service Level Act** of 2020, which went into effect in 2021, states that wastewater utilities are responsible for implementing the necessary adaptation measures to mitigate flood risks due to heavy rains, i.e., roof and surface water runoff (Serviceniveaubekendtgørelsen, 2020). Specifically, this Act aims to ensure that public and private utility companies only finance adaptation measures that are found to be economically viable to prevent "overinvestment". Wastewater utilities can collaborate with any relevant partner to finance the most efficient climate change adaptation initiatives. Wastewater utilities are required to report their level of investment and service provided on a yearly basis. If a new service level is decided by the local authorities (i.e., municipal councils), it is legally binding including when local utilities replace existing facilities related to wastewater or establish new ones (Ministry of the Environment Denmark, 2022).

In 2020, work on a **National Climate Adaptation Plan** started within the current Danish government, with broad support in the Parliament. After the recent Parliamentary Election in 2022, the elected parties have agreed to continue the development of this plan and the task is written on the Government Platform (Danish government, 2022). The National Climate Adaptation Plan is currently being elaborated by cross-ministerial working groups and pends political treatment (Interviews, Denmark). It is presently unknown when it will be published. Meanwhile, adaptation in Denmark continues to take place at municipal and individual levels within the existing frameworks. There are currently no general laws or regulations dictating to what level landowners, municipalities or other stakeholders must adapt to a changing climate, which has resulted in various challenges with respect to implementation across, e.g., municipal, or other administrative boundaries.

Table 2.1: Timeline for adaptation policy in Denmark

Year	Item	Description
2008	National Adaptation Strategy (NAS)	First national strategy on climate change adaptation. Outlines how the government, local authorities, and businesses can work together to achieve the national goals for climate adaptation.
2012	National Action Plan (NAP)	First action plan on how to "climate proof" Denmark. Focused on flooding.
2016 and 2017	Flood Protection Act	Update of the Flood Protection Act from 2009/2010, based on the EU Floods Directive. The updated Act requires regular assessments and management of flood risks from streams and lakes. Partly overlaps adaptation in Denmark.
2018/2022	Revision of the Planning Act	The revised Planning Act requires municipalities to consider climate change when making decisions regarding land use and physical planning. Coastal erosion is now part of municipal adaptation plans.
2019	Climate Act	Denmark's first "climate law", which specifies the reduction of greenhouse gas emissions by 70% by 2030 and the binding target of becoming a net-zero society by 2050.
2020	Service Level Act	The Service Level Act, which came into effect in 2021, obligates wastewater utilities to develop the necessary adaptation measures for mitigating the flood risks due to heavy rains, defined as roof and surface water runoff.
2022	Government Platform	The task of developing a National Climate Adaptation Plan is written into the new government platform after the General Election in 2022.

Division of responsibility

The responsibility for planning and implementing adaptation measures in Denmark is anchored locally. It is a guiding principle that municipalities are responsible for adaptation strategies and planning at the local level, where the impacts of climate hazards are felt the most, whereas landowners, and public and private stakeholders are generally responsible for the implementation. The system is highly decentralized, putting an emphasis on the role of the local communities, companies, stakeholders, and citizens in defining how and to what extent adaptation services are provided, while still being part of a larger framework. The government can override local decisions that conflict with national laws or policies.

The Danish government is principally responsible for policy objectives and for proving the overarching framework for adaptation. It has been pointed out that the current framework is highly fragmented, and that this can be a hindrance to effective adaptation (Interviews, Denmark). Thus, it is primarily the Planning and Service Level Acts that define legal responsibilities ("must do") with respect to adaptation, whereas most other guiding documents and policies mainly provide recommendations ("can do"). This includes at least two key risk areas, where responsibilities are currently not well defined: rising groundwater levels and management of watercourses. While legislation regarding environmental protection of watercourses in Denmark has been firmly in place for many years (i.e., the Act on Watercourses), adaptation is currently not mentioned in the objectives. Nonetheless, in most cases the current legislation within this area seems to be sufficient and to support adaptation policies adequately (Interviews, Denmark).

In the following the responsibilities of the different key actors at national and sub-national levels in Denmark are summarized (see also Figure 2.1 below).

National

The Danish government (*vis-a-vis* the Danish Parliament) is responsible for developing and implementing the policies and legislation needed to advice planning and implementation of actions at the national, municipal, and individual level. In general, the different Ministerial boards are responsible for adaptation and adaptation-related initiatives within their own (sectoral) areas. There is no central coordinating government body, and the level of coordination between different government bodies varies from high to none (Interviews, Denmark). The Danish government provides limited funding for adaptation, mainly related to coastal protection, research and development, which is managed by different government agencies.

Under the Climate Act, the **Danish Meteorological Institute (DMI)** (which is anchored in the Ministry for Climate, Energy and Utilities) provides authoritative advice related to climate and climate change to the Danish government. At the same time, DMI is responsible for delivering data and knowledge to facilitate

adaptation in Denmark, in particular targeting the municipal level. These tasks are embedded within the following activities funded by the Danish government:

- The National Centre for Climate Research (NCKF) is hosted by DMI, who is currently also the main contributor.
- The National Climate Atlas provides data and climate services targeting the municipal level. The Climate Atlas is developed and maintained by DMI and NCKF.
- DMI's Open Data platform includes weather, marine and climate data. This online platform will be fully operational from 2023.
- DMI's role as the National Focal Point to the IPCC.

As of 2023, the Danish government together with a broad selection of political parties has allocated almost 190 million DKK to DMI and collaborating national authorities for developing a novel early flood warning system. It is planned that the system will be extended in steps and be fully operational in 2026. From 1 January DMI became the national authority with respect to early flood warning.

The Environmental Protection Agency (under the auspice of the Ministry of Environment) supports adaptation to climate change by ensuring that adaptation is integrated into environmental legislation and guidelines. The Environmental Protection Agency also maintains the National Climate Adaptation Portal, "Klimatilpasning.dk", which is the national knowledge hub for adaptation, and which provides access to wide range of climate services, information, and data products for municipalities. "Klimatilpasning.dk" is a cross-sectoral collaboration between different ministries, agencies, local governments, universities, research institutes, etc. Together with the Danish Environmental Portal, the Environmental Protection Agency have developed a digital planning and adaptation tool called KAMP aimed at mainstreaming the publicly available data on adaptation to ensure easy access for public planners.

The Danish Coastal Authority (under the auspice of the Ministry of Environment) provides technical support, models, tools, data, economic assessments, and advice to municipalities with respect to coastal adaptation. These include the planning tool Coastal Planner, which includes socio-economic evaluation (The Danish Coastal Authority, 2021). The Danish Coastal Authority is the national authority with respect to the implementation of adaptation along coastlines by the state and otherwise serves in an advisory role to the municipalities. As part of the legal obligations of the Flood Protection Act and the EU Floods Directive, the Danish Coastal Authority is responsible for screening and mapping flood and erosion risks and hazards on a national scale every sixth year. The Danish Coastal Authority manages a limited pool of funding for coastal protection projects (see box 2.2 further below).

Besides these main national authorities, several other government agencies provide specialized services related to adaptation including the **Geological Survey of Denmark and Greenland (GEUS)** and the **Danish Map and Data Supply (SDFI)**.

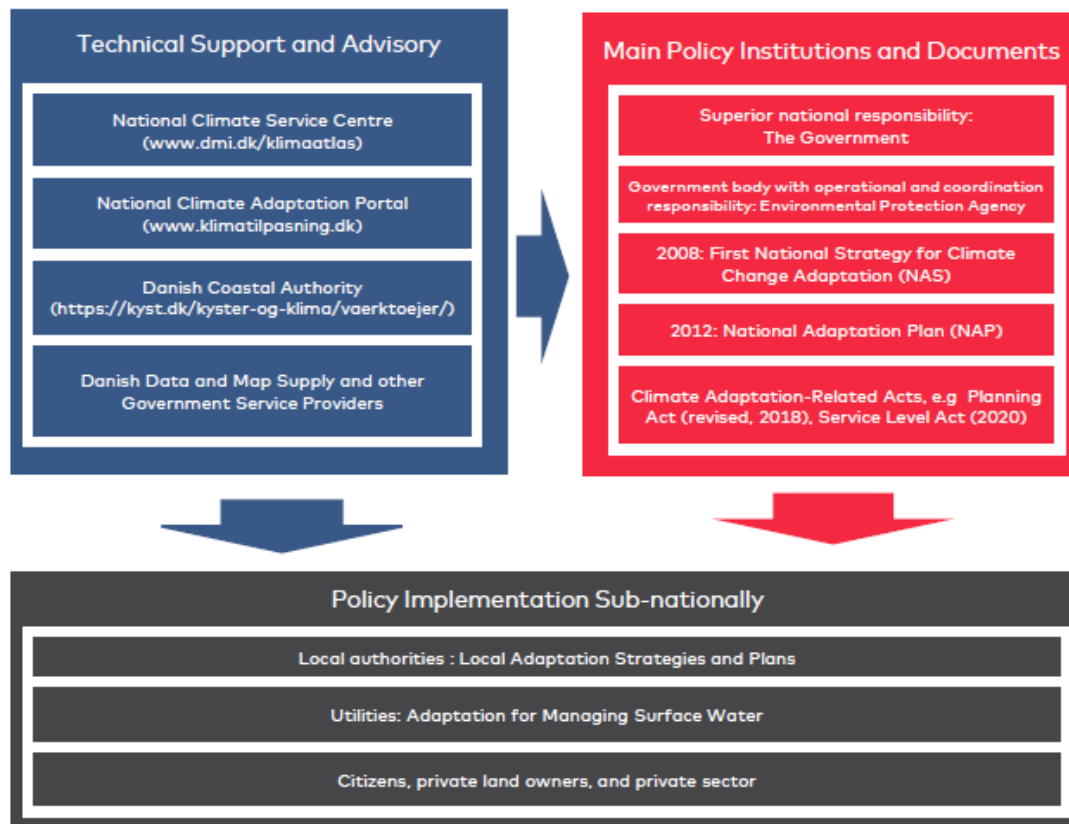


Figure 2.1. Organization of adaptation in Denmark

Sub-national

Municipalities, wastewater utilities, landowners and other local stakeholders are the most relevant actors for climate change adaptation at the sub-national level.

Denmark is divided into five administrative regions and 98 municipalities, each with its own elected councils and a very high degree of autonomy, as affirmed by the 2007 Danish Municipal Reform.

Like the municipalities, the five **Regions of Denmark** are governed by an elected (regional) council. They have no formal responsibilities with respect to adaptation, although in particular the two regions Region Midtjylland and Region Hovedstaden are engaging in various activities including EU-funded projects to support adaptation in the municipalities. The Regions' formal responsibilities cover a few related areas, mainly regional environmental and nature development, and soil

contamination.

Following the Planning Act, Danish **municipalities** have the legal responsibility to consider climate risks in their planning cycles, prepare adaptation plans, and for facilitating their implementation, including flood protection, land use planning, and infrastructure management. Municipalities also have the associated obligation of preparing risk management plans for mitigating the direct effects of natural weather and climate hazards. Municipalities decide (or delegate the task to the local wastewater utility) what service levels local wastewater utilities should satisfy in accordance with the Service Level Act. Since there are no formal requirements defining how often municipal adaptation plans should be revised, this decision is left to the individual municipalities. However, as part of the DK2020 program (see Box 2.1 below), virtually all municipal adaptation plans in Denmark are currently being updated. Municipalities are not in general responsible for financing the implementation of adaptation unless this is to protect public assets, this is the responsibility of wastewater utilities and private landowners.

Box 2.1. The “DK2020” initiative

“DK2020” is a Danish climate change mitigation and adaptation program initiated and coordinated by KL, Realdania, the Danish Green Think Tank CONCITO, the Danish Regions and C40 Cities. The program is funded with 17 million DKK from Realdania, and aims to provide support to Danish municipalities, which will dually raise the level of their local climate work including both mitigation and adaptation strategies to the highest international levels.

Through the program, municipalities receive guidance and advice to develop a climate action plan that meets the goals of the Paris Agreement. This includes planning towards net-zero emissions rates in 2050 and the development of adaptation strategies to make the municipalities resilient to climate events. DK2020 is anchored at the highest political level in the municipalities and is a bottom-up initiative.

In the project, the municipalities commit to the same international standards as used by some of the world's largest cities in the C40 network. It is the first time that C40's standard, "The Climate Action Planning Framework" (CAPF), is here being applied to small municipalities. The DK2020 program was initiated in 2019 with 20 Danish municipalities. Since then, first 44 and then 31 additional municipalities have joined the program in 2020 and 2021, which now includes 95 of the 98 municipalities in Denmark. The initial 20 municipalities from 2019 have all recently finalized their extended Climate Action Plans. As part of these action plans, a systematic monitoring, reporting and evaluation (MRE) system is introduced for the first time. Preliminary evaluations show that the current MRE indicators defined in the municipalities are clearly more targeted at monitoring the municipalities' climate footprint than towards monitoring their progress on climate change adaptation. Moreover, DK2020 has shown that (Interviews, Denmark):

- There is huge capacity at the local level for solving the challenges at hand that seems to affirm the decentralized structure of adaptation in Denmark.
- There is a huge willingness to act (voluntarily) and to commit resources at the municipal level.
- The overarching focus for the municipalities is climate change mitigation.

In April 2023, KL, Realdania and the five Danish Regions established a new “climate alliance”, whose purpose it is to support the implementation of the ambitious plans developed under the DK2020 program with the necessary resources and knowledge (DK2020, 2021).

Local Government Denmark (KL) is the association of the 98 Danish municipalities. KL supports municipal adaptation efforts in terms of facilitating knowledge sharing, capacity building, and as an interest organization. KL is also very active nationally.

The local **wastewater utilities** are responsible for managing stormwater originating from rain, including adaptation to climate change. This often involves close collaboration with the municipalities and stakeholders from the private sector. Adaptation projects initiated by the wastewater utilities – outside of upgrading their own infrastructure - can be financed through an increase in the general water tariffs paid by consumers, and potentially in collaboration with other parties. This arguably represents a democratic approach to adaptation (Interviews, Denmark). However, since such projects may be very costly, under the current legislation (e.g., Serviceniveaubekendtgørelsen, 2020), only adaptation projects that are socio-economically efficient may be financed by the wastewater utilities, i.e., out of considerations to consumers and society as a whole.

Landowners and other private stakeholders and citizens are responsible for adaptation to climate change on their own property. In many cases, this is voluntary, and landowners themselves determine the level of protection of the adaptation measures (if any). This includes adaptation towards all kinds of water-related hazards, e.g., coastal floods, surface flooding induced by runoff from heavy rains and watercourses, and rising groundwater levels. Groups of landowners may form communities to finance, build, and maintain adaptation measures such as dikes. This can be done in collaboration with the local municipality and the private sector. The costs of implementing adaptation measures are generally distributed between public and private stakeholders following a "principle of benefit". Parties that have a higher benefit from the adaptation measures installed, are thus required to fund a relatively larger part than parties who have limited benefit of the adaptation(s). Benefits are documented in terms of risks reduced and in socio-economic terms, using a specific calculation method provided by the national authorities.

Policy themes

In 2012, the centrally convened Task Force on Climate Change Adaptation prepared an analysis called "Mapping climate change barriers and opportunities for action" (Danish Nature Agency, 2012). The report presented a sectoral and cross-sectoral analysis of (physical) climate risks and vulnerabilities in Denmark. 14 sectors were analysed: construction and housing, coasts and ports, transport, water, agriculture, forestry, fisheries, energy, tourism, nature, health, emergency preparedness, insurance, and spatial planning. For each sector, a very basic analysis was carried out, considering the most important impacts of climate change, the relevant division of responsibilities between the authorities and private citizens, possibilities for adaptation, initiatives planned and in progress, and barriers and opportunities

for future action. The task force concluded that while the influence of climate change on different sectors will be both positive and negative, the most significant impacts will be related to flooding (elevated sea levels, storms, more frequent extreme rainfall).

Until now, the largest political focus with respect to adaptation has therefore been related to flood issues both in the coastal zone and inland. This is reflected, for instance, by changes to the 2009/2010 Flood Protection Acts in 2016 and 2017 (the former concerning coastal areas and the latter concerning inland streams and lakes). These changes set out requirements for flood risk assessments and management and established a national framework for flood prevention and protection (Ministry of the Environment Denmark, 2016, 2017b). Conversely, rising temperatures have generally been associated with positive impacts, e.g., more favourable growing conditions. This picture is changing after the North European drought and wildfires in 2018, which caused significant losses, for example in the agricultural sector. As a result, droughts are now also considered within the DK2020 program.

In terms of more general policy themes, the 2012 NAP identifies five areas, where future initiatives are needed, which continues to be focal points for adaptation in Denmark:

- Improving the framework for climate change adaptation by changing and modernizing relevant legislation and regulations to ensure appropriate solutions, especially in municipal adaptation efforts.
- Developing a common knowledge base and ongoing consultancy to understand the implications of climate change and how to adapt to it.
- Strengthening collaboration and coordination among authorities, the business community, and individuals involved in climate change adaptation efforts.
- Promoting green transition by developing and using innovative solutions, which can be a potential area for growth.
- Supporting international climate change adaptation efforts, as climate change is a challenge for neighbouring countries, by reducing the effects of climate change and promoting an ambitious climate change adaptation in the EU that will support Danish adaptation efforts.

Risk assessments

Denmark does currently not have a systematic national climate change risk, exposure and vulnerability assessment across key natural hazards and sectors. Rather, risk assessments at the local to national levels are generally produced for specific purposes. At the local level, these are often related to assessments of the economic viability of certain adaptation investments.

Under the Flood Protection Act, the Danish Coastal Authority is mandated to carry out a detailed risk assessment regarding erosion and flooding for the entire Danish coastline, and to identify high-risk areas, followed by a mapping of the hazards associated with those areas with a focus on health, the environment, cultural heritage, and economic interests. This risk assessment must be revised every six years, following the same three-step procedure of screening, mapping, and planning. As a result of the initial cycle, national risk maps were published in 2021 (covering 10 areas that spanned 22 municipalities). A second updated risk mapping occurred between 2016–2018 as a cooperation between the Ministry of Environment and Food, the Ministry of Finance, the Ministry of Industry, Business and Financial Affairs, the Ministry of Climate, Energy and Utilities and the Ministry for Economic Affairs and the Interior. 27 Danish municipalities spanning 14 areas were identified as being at high risk from coastal flooding. These 27 municipalities were subsequently required by law to develop flood risk management plans, which were completed in 2021. These plans were required to include the following themes: climate change adaptation, coastal protection, and emergency preparedness. The third updated risk mapping as required by the Flood Protection Act is currently ongoing.

The development of risk assessments is supported by various tools. In 2020, the Danish Coastal Authority launched the new nationwide coastal planning and risk assessment tool, Coastal Planner, which covers the entire Danish coastline. This tool maps coastal erosion and flood hazard, vulnerability, and risk. It also includes suggestions for strategies for risk management and specific initiatives for coastal protection that can be applied by municipalities. The DMI Climate Atlas similarly provides regularly updated information on current and future climate hazards to support local risk analyses at the municipal level. The Climate Atlas can be linked with the screening tool ("KAMP") developed by the Environmental Protection Agency. This tool compares selected national data, calculations, and projections to provide a simple risk assessment.

The socio-economic consequences of climate change have rarely been analysed at the national level. In 2021, the Danish National Bank used a simple method to confirm that flood risk can potentially affect the exposure of a large share of banks and other credit institutions in Denmark. These currently account for values in the order of DKK 41 billion today and could increase to DKK 198 billion by the end of the century. On behalf of the Ministry of Environment, the Technical University of Denmark (DTU) recently carried out a nationwide analysis of the socio-economic consequences of floods (Halsnæs et al., 2022). The report is a literature study that analyses the socio-economic costs of floods caused by storm surges, cloudbursts, water courses, and high groundwater levels, as well as the associated costs of adaptation for risk reduction. The study compares existing Danish research on flood mapping, socio-economic calculations, and climate scenarios and concludes that coastal flooding is likely to cause damages in the order of billions over this century.

The study further found that while national estimates of climate adaptation costs are lacking, some municipalities have estimated these costs for limited areas. No comprehensive studies exist for flooding from cloudbursts, streams, and groundwater, and local studies indicate large additional costs to adapt to these hazards. Overall, the report found that floods and climate adaptation will incur significant socio-economic costs, while suggesting that further studies are needed to support socio-economically effective policies and implementation of adaptation (Ibid.).

Some cost-benefit analyses have been conducted in Denmark, for instance as part of assessing the economic feasibility of the 2012 cloudburst management plan, developed to prevent surface water flooding associated with heavy precipitation in the municipality. As part of the assessment of the plan, the city of Copenhagen assessed and compared the costs of two solutions: increasing the dimensions of the sewerage system and using green infrastructure. The analysis showed that both solutions would reduce the cost of damage by DKK 16 billion over the course of their lifetime (100 years), through both avoiding damage and generating income through taxes and employment. The green infrastructure was less costly to implement, however, resulting in a DKK 7 billion difference. Informed by the cost-benefit analysis, the city has now implemented a combination of the two solutions (European Environment Agency, 2023).

Systems for monitoring, reporting, and evaluation

Denmark does not have a formal system for monitoring, reporting, and evaluation (MRE) of planned or realized climate adaptation. Still, over the last decade, adaptation has been reported and evaluated to some degree, and been the subject of research.

In 2016, the Ministry of Environment together with the Ministry of Climate, Energy and Utilities and the Ministry of Business and Growth carried out a national evaluation of climate change adaptation in Denmark (Ministry of the Environment Denmark, 2017a). The assessment was based on desk research supplemented by interviews with key stakeholders, and focused on the following four criteria:

- The ability of wastewater utilities to financially support municipal investments.
- Guidelines outlining which activities can and cannot be financed through tariffs.
- The implementation of municipal plans for climate adaptation.
- The efficiency of socio-economic efforts, potential bottlenecks for the realization of projects, and the need for updating the climate change adaptation plans.

In the context of the flood risk management plans developed under the Flood Protection Act, the appointed municipalities are required to regularly report on the measures planned to reduce their flood risk as well as on additional measures implemented. These measures are categorized as: prevention, protection, preparedness, and preliminary work; they are reported by the municipalities as: completed, continuously, in progress, postponed or cancelled.

The DK2020 program has for the first time introduced a comprehensive procedure for mainstreaming the MRE of adaptation at the municipal level, based on the C40 Action Planning Framework (C40 Cities, 2020). This system uses continuous monitoring and status reporting on key performance indicators (KPI's) of the municipalities. Here the extent and focus areas for the MRE vary between the different municipalities.

2.2. Policy instruments

Capacity building

As indicated above, the overarching emphasis has been to build capacity on adaptation within and through the Danish national authorities, in particular within the Ministry of Environment and the Ministry of Climate, Energy and Utilities. This has among other actions led to a significant strengthening of DMI and the Danish Coastal Authority, and to the development of the abovementioned tools and knowledge centres to support climate change adaptation in the municipalities, including the NCKF/National Centre for Climate Research (DMI), the Climate Atlas (DMI), Coastal Planner (Danish Coastal Authority), KAMP (Ministry of Environment), and the national climate adaptation portal, "Klimatilpasning.dk". Similar developments have taken place within other national authorities albeit at smaller scales, including the Geological Survey of Denmark and Greenland/GEUS and the Danish Map and Data Supply/SDFE. That said, outside of the "classical" sectors, where adaptation is already a main priority, there is arguably still insufficient resources and expertise at the national level in other sectors (Interviews, Denmark).

There has also been a general strengthening of the adaptation area within the municipalities and among other stakeholders. However, while some (typically larger) municipalities have extended their expertise over the past decade, other municipalities are still very limited in both expertise and resources for adaptation. It has been pointed out that there is a gap between the ongoing development and dissemination of new advanced data and tools from the national authorities, e.g., DMI, and the local capacity for using these assets in Danish municipalities. Preliminary results from an evaluation of the ongoing DK2020 program suggest that this may have been enhanced by the fact that a lot of municipalities lost their

focus and their expertise on adaptation after the completion of the municipal adaptation plans in 2013–2014. In addition, municipalities with already high capacities traditionally work closer with academic partners, who can help raise the quality of adaptation projects and plans (Interviews, Denmark). Finally, most Danish municipalities depend critically on services offered through consultants and engineering companies, which limit the transfer of knowledge and expertise.

In response, several “bottom-up” initiatives have emerged that aim particularly at supporting adaptation in the municipalities. Recent and ongoing initiatives include the DK2020 program (see Box 2.1 above); the National Network for Climate Adaptation (DNNK), which was founded in 2020 on the basis of existing Danish networks and initiatives related to adaptation; the project “Cities and Rising Sea Levels”; and other activities organized by, e.g., KL and the business association for water and wastewater utilities in Denmark, DANVA. For example, KL is currently managing a project that aims at improving knowledge-sharing, data utilization and implementation of common data management practices in climate adaptation across all Danish municipalities. This project runs until 2025 and will provide an overview of pertinent tools, data, and stakeholders in climate change adaptation (Local Government Denmark, 2023). Interestingly, many of the abovementioned initiatives have been made possible due to funding from Realdania, which is a private philanthropic association that has gained a key role in the funding landscape for climate change adaptation in Denmark (see box 2.2 below).

Through the research councils (e.g., the Independent Research Fund of Denmark, and the Innovation Fund Denmark), specific “green calls”, and different development and demonstration programs within the Ministries, the Danish government is funding research, knowledge, and method development as an instrument for supporting climate change adaptation. While the economic magnitude of these activities is marginal compared to investments related to climate change mitigation, several research projects have contributed actionable knowledge on adaptation. This includes an open-source tool called “SkadesØkonomi”, used for estimating the economic losses due to flooding across a number of sectors, which is endorsed by KL, and which has been taken up by a large number of Danish municipalities.

Incentive mechanisms

Climate change adaptation in Denmark is mainly incentivized by the legal responsibilities of the different actors outlined above (see section 2.1). As a result, there are large variations at both national and sub-national levels with respect to adaptation actions and investments, which can easily be explained by differences in political priorities and the availability of local resources including economic resources.

There is no overarching framework for funding climate change adaptation in Denmark. Rather the financing landscape for adaptation is fragmented and spread across several sources. It is often stated that current funding levels from the state are too limited, and that larger pools are needed to support those municipalities and other stakeholders, who are unable to cover their own needs (Interviews, Denmark). A national overview of adaptation investments however does not exist, although some municipalities disclose this information voluntarily on an annual basis. So far, most of the available sources of financing are related to coastal flooding, erosion, and cloudburst-induced flooding (see box 2.2 below).

There are few direct economic incentives related to climate change adaptation at the local level. Arguably, the primary incentive for landowners and other local stakeholders to engage and invest in adaptation is related to their perceived picture of climate risks and vulnerability (which may or may not be skewed) rather than estimates of the expected annual damage based on climate projections and socio-economic analysis (Interviews, Denmark). Also, according to our informants, many stakeholders are unaware of their own responsibilities as opposed to those of, e.g., the municipality or the national authorities. This naturally serves as a disincentive for adaptation. In this light, improved knowledge and capacity building among local stakeholders could be expected to serve as an effective incentive mechanism, although adaptation remains a poor investment case for a private landowner or local stakeholder. To incentivize adaptation, it has been proposed that municipalities could offer favourable loans to stakeholders to finance adaptation via a special financial institution available only to Danish regions and municipalities ("KommuneKredit"). Where co-financing of adaptation solutions by the municipalities is applicable, this also provides an important incentive for adaptation (Interviews, Denmark).

To facilitate investments by wastewater utilities, e.g., in adaptation under the Service Level Act (see box 2.2 below), the Ministry of Economic Affairs and the Interior has recently changed the Statutory Order on loans. As a result, municipalities' loan guarantees towards investments by wastewater utilities have been extended from 25 to 40 years for new loans. The purpose of this change is to ensure a better agreement between the repayment of loans by wastewater utilities and the tariffs imposed on consumers. The action plan furthermore states that the Ministry of Transport will consider how climate change adaptation can be addressed in a revised version of the Public Roads Act. The current version of the act, which dates back to 2014, does not touch upon adaptation (Ministry of Transport, 2014).

Box 2.2. Examples of adaptation financing in Denmark

- The Service Level Act (Serviceniveaubekendtgørelsen, 2020) defines **water tariffs** as the means to finance adaptation related to heavy rain. In this way, wastewater utilities can finance adaptation related to their own operations, or take part in joint projects, involving, e.g., municipalities and other stakeholders. To prevent over-investments, municipalities can decide to heighten wastewater utilities' service levels in accordance with socio-economic viability, calculated using a method defined by the state. The method is a six-step procedure, involving hydrological modelling and flood mapping, risk, cost and damage quantification, and cost-benefit analysis of the suggested adaptation measures. Wastewater utilities can collaborate with any relevant partner to finance the most efficient climate change adaptation initiative but may not finance adaptation that is not economically viable.
- A **national funding instrument to support coastal protection** has since 2020 been available to municipalities. The pool is managed by the Danish Coastal Authority and has been granted annually for three years. In 2023, 10 new projects along the Danish coastlines were granted a total of DKK 150 million for reducing the risks of flooding and erosion (Ministry of Finance Denmark, 2023). In 2022 the amount was DKK 90 million ([Klimatilpasning.dk](https://www.klimatilpasning.dk)).
- A renewal of an ongoing collaboration on **coastal protection** of the Danish West coast for the period 2020–2024 was agreed between 4 municipalities and the Danish state. In the period from 2020 to 2024 a total of approx. DKK 204 million per/yr. are invested in coastal protection shared between the four municipalities. This will primarily cover sand nourishment in larger or smaller quantities along the 110-km coastline.
- Except for cases as the above, where the state and/or municipalities decide to invest in adaptation, property owners along the coast are principally responsible for protecting their own grounds. This is frequently done through **joint collaborations** (e.g., "dike guilds"), which may or may not be co-funded by the local municipality. This decision is up to the municipality, which according to the Coastal Protection Act has the right to push forward such projects (Denmark, interviewee 1). In terms of financing, a principle of "benefit-gain" is applied, implying that even landowners whose properties are located behind the coastline are required to co-finance the adaptation, according to their "gain".
- Within the last few decades, the large private philanthropic association **Realdania** has provided resources matching the current state funding for both planning and implementation of adaptation projects in Danish municipalities and supported capacity building.
- Finally, a substantial number of Danish municipalities currently partner in **EU-funded initiatives** related to adaptation, including Interreg Programmes and actions related to the Horizon 2020, Horizon Europe Framework Programmes, and the EU Mission on Adaptation. Even so, it was pointed out that perhaps this potential is still not fully exploited (Interviews, Denmark).

The role of insurance as an incentive mechanism to support climate change adaptation in Denmark is currently non-existing. While it is possible that particularly exposed properties may eventually become uninsurable, or that they can only be insured against paying relatively high insurance premiums, this is so far not an issue. Further, due to the state insurance instruments for natural catastrophes, which principally cover disastrous storms and storm surges, at the present Danish insurers have no incentive to offer differentiated premiums (Interviews, Denmark). It is entirely possible that potential changes on the global insurance and reinsurance markets due to the increasing number of extreme weather and climate events could trickle down to Danish insurance companies and their customers.

2.3. Best practices and main challenges

The current status on climate change adaptation in Denmark was evaluated as part of the "Adaptation preparedness scoreboard" in 2018. It was highlighted that although all Danish municipalities have developed local action plans for adaptation, **current adaptations plans are uneven in terms of detail and coverage**. Also, with respect to the practical implementation of these plans, the progress was found to be uneven. The EU evaluation emphasized the lack of a systematic monitoring or evaluation mechanism using relevant indicators for the NAS, NAP, or local adaptation plans (see above). Likewise, the evaluation noted that no systematic monitoring of results of sectoral policies was conducted or disseminated. Similar conclusions were found in a parallel evaluation, which also noted the significant disparity in the level of detail of individual municipal adaptation plans as well as in the scope of the themes included in the associated risk and vulnerability assessments (Krausing et al., 2017).

The current disparities can to some degree be ascribed to the fact that the **current legal and regulatory framework for adaptation is highly fragmented**, as described above, that adaptation has so far been low on the political agenda compared to mitigation actions, and to the absence of a National Climate Adaptation Plan. It is also evident that there is an urgent **need for more holistic thinking from the national to the local level** (Interviews, Denmark). Hence, a lot of the relevant legislation is currently defined within constrained silos, within different Ministries with different responsibilities, which makes it difficult to solve the challenges posed by different national and EU regulations. For example, the EU Floods Directive foresees a 6-yearly cycle, whereas the DK2020 program commits updates every four years. A similar situation is often found in municipalities with key competences and responsibilities being spread across different technical departments and subject to different planning cycles.

While the availability of relevant data and climate services has improved, there is arguably still a **need for additional and improved tools, data sources and knowledge**, in particular at the local level. There is also an urgent need for mainstreaming to raise the quality of the analyses underpinning adaptation decision-making and implementation, to avoid unrealistic goals or simplifications. This includes current tools for socio-economic assessments as such tools play a key role for adaptation decision-making and financing in Denmark, as well as considerations of what the "normal" risk levels are as opposed to risk changes due to climate change under different transformational and socio-economic scenarios. At the present, different sectors tend to develop their own risk analyses based on different data and assumptions, introducing uncertainty and a lack of consistency when considering adaptation from a holistic perspective. Part of the explanation could be that the use of increasingly complex data and tools delivered through, e.g., the DMI Climate Atlas or Klimatilpasning.dk are not just "plug-and-play". To utilize them demands a lot of **local capacity building and enhanced expertise amongst users** in the municipalities (Andersen et al., 2021), and technical support that is currently not readily available.

Danish stakeholders often emphasize the challenge in the **lack of adequate funding and financial support** towards climate change adaptation, while a better overview of funding opportunities both on a national level, and within the EU is in high demand. While both the Planning and the Service Level Acts provide valuable frameworks for the planning and implementation of adaptation, they also have their deficiencies. One of our informants been pointed out that in the case of joint municipal projects, only one municipality is ultimately responsible and will bear the full financial burden. Likewise, neither of the current funding sources cover retreat and relocation, which could become a viable adaptation option with rising sea levels. Finally, public-private partnerships are highly encouraged. However, despite a high potential, the current level of public-private partnerships is still limited (Interviews, Denmark).

In a recent study by the University of Copenhagen (Andersen et al., 2021), the role of stakeholder engagement and cross-sectoral collaboration in climate change adaptation was investigated. The study highlights the **critical importance of involving stakeholders** and suggests that while a lot of Danish municipalities are already embracing a deep stakeholder involvement as part of adaptation projects, there is still room for improvement. It also suggests that social science perspectives need to be better integrated for a truly transformative adaptation to take place.

Implementing the EU's Flood Directive has had a **positive influence on raising awareness of climate change adaptation** in Denmark. After the first two cycles, the Danish Coastal Authority finds that the municipalities designated as high-risk areas and thereby are obligated to prepare risk management plans, are now further ahead in their climate change adaptation compared to other municipalities.

Hence, preparing the risk management plans encouraged the municipalities, within a statutory framework, to analyse hazards and risks in relation to flooding, set targets for risk reduction, prioritize efforts, identify responsibilities, and follow up on implementation. In this way, the municipalities become aware of the consequences of flooding and must deal with the dilemmas and challenges that adaptation entails.

The **DK2020 program** demonstrates many of the abovementioned points and challenges and will also suggest possible solutions and best practices. Importantly, the program so far seems largely to endorse the current structure in Denmark, where adaptation is primarily founded at the local level and in the municipalities. In turn, this highlights the importance of the National Climate Adaptation Plan for Denmark to realize an improved and more holistic framework, promote cross-sectoral thinking, and harmonize adaptation in the municipalities.

3. Finland

3.1. Governance structure

National adaptation policy-landscape

National adaptation policy has been developing during the past 20 years in Finland. Finland was the first country in Europe to publish a National Adaptation Strategy (NAS) in 2005^[1] (see Table 3.1 below). In 2014, the NAS was supplemented with a National Adaptation Plan (NAP), which was revised in 2023. In addition, many ministries have published sectoral implementation plans based on the NAS. Both the NAS and the 2014 NAP have gone through an interim evaluation and a final evaluation. To support the planning of national climate policy, there have been several research programmes and projects, funded through the Finnish government's financial instruments.

The first Climate Act entered into force in 2015 and the revised Climate Act (423/2022) in 2022. It lays down the provisions on climate change policy planning and related monitoring and sets the national climate objectives. The Act also imposes obligations on the authorities on climate change adaptation, including the requirement for a national adaptation plan. The aim of the planning system is to make sure that Finland will reach the targets with respect to both climate change mitigation and the preparations for this. The Act denotes that each Ministry prepares the part of climate policy plans respective to their own administrative branch.

In addition to adaptation-specific policy developments, adaptation has been advanced in relevant sectoral regulation. For example, the Land Use and Building Act and the National Land Use Guidelines, which give guidance to municipalities on land use, include adaptation as one of the goals.

1. While the NAS is more like a plan than a strategy, and could thus better be described as a NAP, we adhere to the official designated terminology by both the Finnish government and the EU.

Table 3.1: Timeline for adaptation policy in Finland

Year	Item	Description
2005	National Adaptation Strategy (NAS)	First comprehensive strategy for national adaptation that was developed jointly with all ministries
2006	Climate Change Adaptation Research Programme ISTO	A research programme (2006–2011) developed to support the implementation of NAS by addressing knowledge gaps.
2006	Management group of the adaptation research programme	An inter-ministerial group to support the implementation of national level adaptation.
2007–2009	Midterm evaluation of NAS	First evaluation of NAS
2008	Action Plan on adaptation of the environmental administration	First sectoral implementation plan of NAS by the Ministry of Environment (2008, 2011)
2009	Climate policy programme for the administrative branch of the Ministry of Transport and Communications	First sectoral implementation plan of NAS by the Ministry of Transport and Communications (2009, 2013)
2011	Climateguide.fi portal	Launch of the adaptation portal that is directed at municipalities and citizens with the aim to disseminate knowledge and information related to climate change and adaptation
2011	Action Plan for the Adaptation to Climate Change of the Ministry of Agriculture and Forestry	First sectoral implementation plan of NAS by the Ministry of Agriculture and Forestry (2011–2015)
2013	Final Evaluation of NAS	Final evaluation of NAS (2011–2013)
2014	National Adaptation Plan (NAP)	The first National Adaptation Plan
2015	Climate Act	First Climate Act, stating that the Government has to report annually on adaptation (alongside mitigation) and has to produce a risk assessment and a national plan
2019	Midterm evaluation of NAP	First evaluation report that assesses the implementation of the 2014 NAP
2022	Climate Act	Revision of the Climate Act, laying down the provisions on climate change policy planning and related monitoring and setting the national climate objectives
2023	National Adaptation Plan (NAP)	Publication of the second NAP, alongside a risk assessment

Division of responsibility

Finland is a parliamentary representative democracy with the government having executive power. As of 2023, there are 12 ministries that function as administrative and political units and prepare Government decisions within their mandates. The presence of the state at the regional level is concentrated in 6 regional state administrative agencies (AVI) and 15 Centres for Economic Development, Transport, and the Environment (ELY). Regional state administrative agencies have mostly law enforcement, rescue, and judicial duties: police, fire and rescue, emergency readiness, basic services, environmental permits and enforcement and occupational health and safety protection. The ELY Centres implement labour and industrial policy, provide employment and immigration services, and promote culture; maintain highways, other transport networks and infrastructure; and protect, monitor and manage the environment, land use and water resources (ELY Centre, 2021). There are 309 municipalities that have a large degree of autonomy in terms of decision-making, including allocation of resources and land use. With the healthcare 2023 reform, many of the adaptation-related functions (such as rescue services, health, and social care) have been transferred to wellbeing services counties (Finnish Ministry of Social Affairs and Health, n.d.), while municipalities' functions relevant for adaptation are more related to areas such as the built environment (Interviews, Finland).

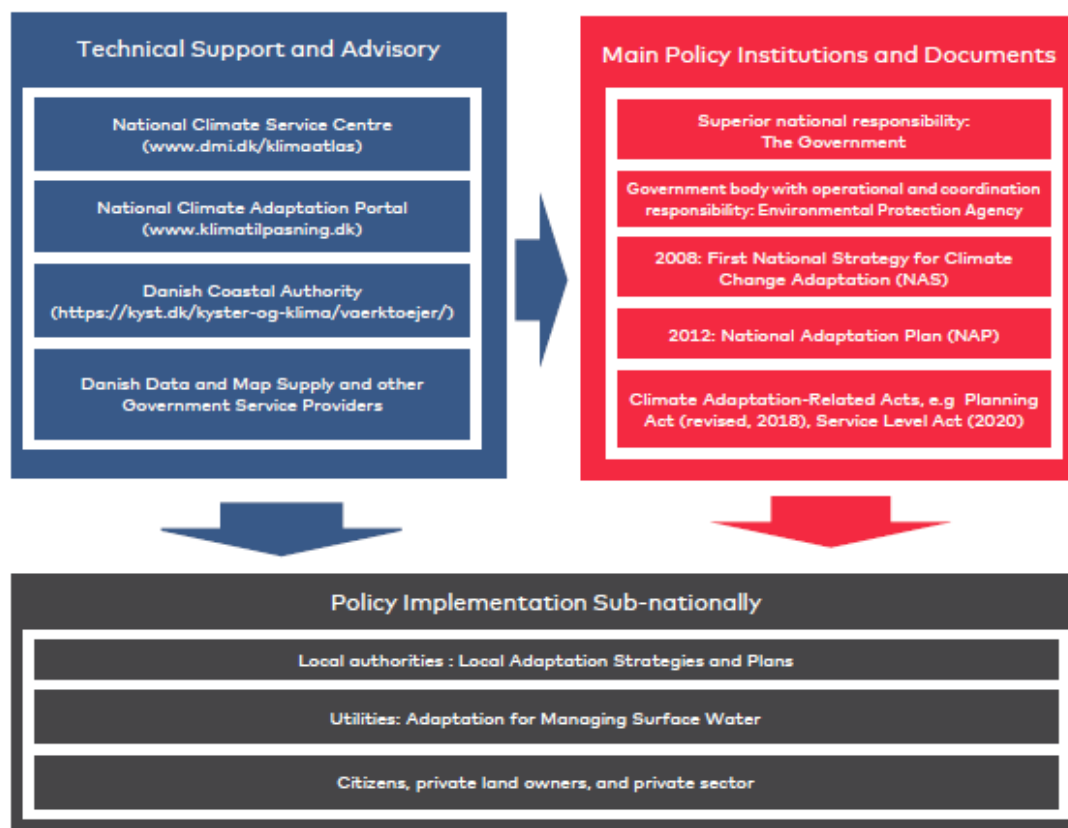


Figure 3.1. Organization of adaptation in Finland

National

The Finnish Government has the main responsibility for promoting adaptation actions necessary for securing functions vital to society, and the overall promotion of adaptation in cooperation with the municipalities, business operators, citizens and various organisations representing these. Currently, the Climate Act does not allocate responsibilities for adaptation beyond the central government authorities.

The Ministry of Agriculture and Forestry (MAF) has the coordination responsibility and was the Ministry in charge of leading the preparation of the 2023 NAP, with the practical work steered by **a broadly-based preparatory group** appointed by the ministry. The various ministries are responsible for the implementation, monitoring and evaluation of the plan within their respective administrative branches.

Additionally, the **National Emergency Supply Agency** operating under the Ministry of Economic Affairs and Employment performs functions that contribute to adaptation, more specifically those related to the maintenance and development of national security of supply.

A national monitoring group was appointed to follow and evaluate the implementation of 2014 NAP, with representatives from the relevant ministries, research institutions, regional and local bodies, and actors. The group met 4–5 times a year and was responsible for following the implementation and communication relating to the adaptation plan, promoting the cooperation between sectors in adaptation actions, and supporting the overall awareness raising on adaptation. In the period of 2020–2022, the group consisted of members from:

- Ten ministries: Agriculture and Forestry (3), the Environment (1), Transport and Communications (1), Defence (1), the Interior (1), Health and Social Care (1), Economic Affairs and Employment (1), Finance (1), Foreign Affairs (1) and the Prime Minister's Office (1).
- Eight agencies, institutes and associations of which National Emergency Supply Agency (1), Natural Resources Institute Finland (1), Finnish Meteorological Institute (1), Finnish Environment Institute (1), Finnish National Agency for Education (1), Finnish National Rescue Association (1) and Finance Finland (1) are governmental agencies and Association of Finnish Municipalities (1), which is an interest organisation,
- Three regional entities: regional Centres for Economic Development, Transport and the Environment (1), which is a governmental agency, and regional councils (1), and Helsinki Region Environmental Services Authority (1), which represent regional authorities.
- And experts from the Finnish Institute for Health and Welfare (2), the Finnish Transport Infrastructure Agency (1) and the Ministry of Agriculture and Forestry (1) (Finnish Ministry of Agriculture and Forestry 2020).

The group will be reassembled for the monitoring of the 2023 NAP, but the composition of the group is yet to be determined.

The Finnish Climate Change Panel, which was established based on the Climate Act, is an expert panel that brings together high-level researchers on climate change and has some resources to carry out synthesis work. The Climate Panel is legally mandated to comment on the government's climate plans annually. It is also able to carry out synthesis work on climate policy issues, which it considers important to inform the government's action. The Panel has a rotating membership with a strong multidisciplinary expertise selected from universities and research institutes (The Finnish Climate Change Panel, n.d.).

Sub-national

At the sub-national level, **Centres for Economic Development, Transport, and the Environment** (ELY) (15 in total) are responsible for the regional implementation and development tasks of the central government. From the adaptation perspective, more specific areas of work include land use, transportation, environmental protection, biodiversity protection, construction and built environment, cultural environment, flood management, water resources use and management, as well as agriculture and fisheries related tasks. Additionally, the **ELY Centres** advance adaptation as part of regional development, and advisory, funding, development services for the private sector, as well as promotion of competence and lifelong learning, and agricultural and rural development. Important tasks in terms of adaptation also include monitoring the public interest in environmental and water matters, producing, and distributing environmental information, and improving environmental awareness (MAF, 2022). Many of the tasks carried out by the Centres require taking into account the adaptation needs, even though all the work is not necessarily recognized as adaptation (MAF, 2022).

The 2014 NAP did not allocate responsibilities of adaptation to Finland's 309 **municipalities** (average population size of 17 955 and a median population size of 5 967 residents, as of 2022). This was originally intended to be included in the revision of the Climate Act in 2022 but did not happen. Currently, all municipal stand-alone plans are voluntary or are a result of collaboration in city climate networks. These networks include national ones, which are predominantly mitigation-focused but also encourage adaptation (e.g., the 6-Aika cities and the HINKU network), or international networks (e.g., Covenant of Mayors), of which some of the larger cities have become members. Some cities have also established their own networks for private sector actors and companies to advance both mitigation and adaptation in the private sector (e.g., the Climate Partnership Network in Helsinki).

Under a health sector 2023 reform, a total of 21 self-governing **wellbeing services counties** have been established in Finland. The responsibility for organizing health, social and rescue services has been transferred from the municipalities and joint municipal authorities to the wellbeing services counties (Finnish Ministry of Social Affairs and Health, n.d.). The highest decision-making power in each wellbeing services county will be exercised by a county council, whose members and deputy members are elected in county elections. These services are also important in adaptation, and the outlining of responsibilities and adaptation needs within the counties' work will be carried out (Interviews, Finland).

Policy themes

In the 2023 NAP, adaptation is also framed as an issue of comprehensive security, based on national cooperation. In this cooperation, critical societal functions are maintained through collaboration between public officials, private sector, third sector and citizens. The principles of the comprehensive security approach are described in the broader national security agenda, of which modelling of threats is updated regularly. In these scenarios, climate change is considered mainly as a threat multiplier (MAF, 2022).

The 2023 NAP identifies 12 themes that are central to adaptation in Finland, with 1–3 objectives identified for each theme (a total of 24 objectives). The themes are:

- Governance.
- Comprehensive security and general preparedness.
- Food and nutrition security.
- Infrastructure and built environment.
- Drought risk management, use of and care for natural resources, biodiversity, and Nature-based Solutions (NbS).
- Healthcare.
- Cultural heritage and cultural environment protection.
- Regional and municipal risk management.
- Strengthening (and mobilizing) the knowledge base.
- Communication and interaction.
- International cooperation.
- Monitoring and evaluation.

Besides these, other themes are emerging within the national adaptation discourse, such as justice in adaptation (see box 3.1).

Box 3.1. Justice in national adaptation as emerging policy theme

One of the objectives of the Climate Law (432/2022) and related adaptation policy is ensuring just climate action, both with regards to the content and to the methods of planning. During the project "Climate Justice" funded by the Finnish Climate Change Panel there was developed an index of adaptation justice in climate policy, which has been further used to analyze justice in Finland's adaptation policy (Juhola et al., 2022).

Adaptation justice is approached through four dimensions: restorative, distributive, procedural and recognitional. The results show that Finland has scored high on procedural justice, moderately on recognitional and distributive and low on restorative, with gaps identified across all dimensions of justice. The main areas for improvement are the distribution of costs and benefits (both in terms of climate risks and adaptation measures, distributive justice) and their compensation (restorative justice) (Ibid.).

The aspects of justice related to the impacts of climate change and adaptation actions are considered to be central to the national adaptation strategy (Hildén et al., 2022). The preparation of the 2023 NAP was carried out in consultation with a diverse group of stakeholders, including Sami population representatives, as well as associations for young and elderly people, and people with disabilities. The new plan also acknowledges that the risks are distributed unevenly and sets the objectives to include justice assessments for adaptation action. It has also been acknowledged, however, that restoring past injustices or addressing structural inequalities related to e.g., socioeconomic factors does not necessarily lie within the scope of the new adaptation strategy. Nevertheless, the starting point for any adaptation action should be that no new vulnerabilities or inequalities are created, or existing ones deepened (MAF, 2022).

Risk assessments

The Climate Act requires a risk and vulnerability assessment, and this will be carried out periodically in relation to the NAP. The previous one, a stand-alone assessment, was funded through government research and innovation funding (Tuomenvirta et al., 2018). Overall, the institutional set up for assessing climate vulnerability and risks is based on work by research institutes and universities that carry out research on climate change impacts, adaptation, and mitigation (see box 3.2 below).

The 2023 NAP is based on a scenario-based assessment of risks that is presented in a separate attachment to the plan. Sectors for which climate risks are examined include nature and ecosystems, natural resources, infrastructure and built environment, health, financial sector, indirect risks, individual and community level vulnerability and institutional vulnerability (MAF, 2022).

The plan itself includes the following considerations:

- Consideration of climate change impacts (e.g., changes in temperature and precipitation).
- Consideration of climate risks, including both the natural environment (e.g., ecosystems and biodiversity) and society (e.g., built environment, health, agriculture and cultural heritage), with a special consideration of the Indigenous Sami population.
- Secondary (transboundary) effects of climate change in Finland (e.g., food production, raw materials and human migration).

While transboundary climate risks (TCR) are on the agenda, concrete actions towards transboundary risk management are rather difficult to plan and implement (Interviews, Finland). Additionally, with regards to the emergency supply (e.g., food security), most of its functioning is carried out by the private sector, and government has limited options to steer adaptation, mainly through e.g., information, guidance, and in exceptional crisis situations like e.g., COVID pandemic, with subsidies (Interviews, Finland).

Box 3.2. Research informing national climate risk assessments in Finland

The project ELASTINEN (2015–2016) examined the state of climate risk management, assessed ways to manage risks and examine the roles of different stakeholders, including municipalities and organisations (Gregow et al. 2016, Tuomenvirta et al. 2019). More specifically, the project examined the impacts of climate change and extreme weather events on the functioning of Finnish municipalities and organisations, sources of climate information the organisations and municipalities use and perception of climate and non-climate information services and usability (e.g., Räsänen et al., 2017).

The project SIETO (2017–2018) produced a national climate risk and vulnerability assessment, focusing on the vulnerabilities of different sectors to climate change related hazards and extreme weather events (Tuomenvirta et al., 2018). The results were used to support the implementation of the National Climate Change Adaptation Plan 2022 (NAP2). Additionally, the risk assessment carried out in the project was used to produce a governance model for future risk assessments.

The project SUOMI (2020–2022) is a Finnish Climate Change Panel project that produced synthesized information for the National Climate Change Adaptation Plan 2030 and the revisions of the Climate Law (432/2022). The project specifically focused on the regional accurate climate risk assessments for current and future risks, as well as on the instruments and costs and benefits of climate change adaptation (Gregow et al., 2021).

Systems for monitoring, reporting, and evaluation

The 2023 NAP sets out to establish a system for monitoring, reporting and evaluation (MRE), which will enable the monitoring and evaluation of each action based on designated goals, using quantitative indicators when sensible. The preparation work is to start in 2023. The interviewees did not provide further details on this. It is apparent that the creation of a large MRE system assessing risk reduction as in e.g., the UK, is not feasible nor reasonable (Interviews, Finland).

Despite the lack of a dedicated MRE system, both the Climate Act and the 2014 NAP have included reporting requirements. The Climate Act requires the government to publish an Annual Climate Report on climate adaptation progress. This means that the Government reports on any advances on adaptation in the yearly climate policy report, which also includes advances on mitigation.

The 2014 NAP required ministries to report to the coordinating ministry regarding the progress on implementation. Their tasks included:

- Promoting the adaptation-related cooperation of state authorities and various industries.
- Identifying adaptation-related research needs and making proposals for research development.
- Promoting the practical application of research knowledge and guiding projects that serve adaptation.
- Promoting communication and knowledge about adaptation.
- Supporting the implementation of the EU's adaptation strategy in Finland and the preparation of national policies related to EU affairs.
- Monitoring and reporting the implementation of the adaptation plan and promoting the assessment of the effectiveness of adaptation measures.
- Contributing to the preparation of the next adaptation plan.

Both NAS and the 2014 NAP have been reviewed. NAS had an interim review in 2009 (MAF, 2009) and final review in 2013 (MAF, 2013). The method for the 2009 review was based on Ministries self-reporting and an evaluation scheme (a scale of 1–5). The review found that adaptation as an issue was recognized in most ministerial sectors but that only a few adaptation measures had been identified or implemented (2 out of 5 on the evaluation scale). The 2013 final review of the national adaptation was based on reporting from the Ministries responsible for implementation. This was combined with a round of expert interviews, as well as two rounds of expert workshops that focused on specific thematic areas, such as climate change and health, industry and insurance, and ecosystem-based adaptation. The evaluation found that adaptation measures had increased and that there was cross-checking of synergies and conflicts between adaptation and other policies. Managing the uncertainties related to the effects of climate change

was found to require further knowledge of climate impacts.

The 2014 NAP interim review was published in 2019 (Mäkinen et al., 2019). The review assessed the implementation of NAP and identified the needs for development. The review method included group interviews and regional stakeholder workshops, as well as a national survey and documentation based on self-evaluation. The review found that while the effects and risks associated with climate change are being discussed more broadly, measures to manage climate-related risks are still lacking. The most important needs for development have to do with increasing awareness of weather and climate-related risks and the possibilities to adapt to them, clarifying the roles and responsibilities related to adaptation and ensuring well-functioning coordination.

The KOKOSOPU project that was funded by the VN TEAS funding instruments assessed the progress made on adaptation (Hildén et al., 2022). The assessment covered all administrative branches and checked recent strategic and legal documents for evidence on recognition of climate change. The project also explored regional and local level adaptation activities through workshops and a survey targeted at municipalities and collected information on resources devoted to adaptation. Based on the analysis, all branches and levels of administration recognise climate change as a relevant topic – explicit references to climate change are made in numerous documents. The level varies, in some it is a mere statement whereas in others concrete action is foreseen. Many of the challenges that were noted have been observed in all countries working to strengthen adaptation: a lack of resources hinders progress and there is a need for knowledge on how to address climate change in specific local contexts and sectors. Some authorities, especially at the regional and local level, are also uncertain about which organisation should take the lead in adaptation activities that cross administrative borders (Hildén et al., 2022; Interviews, Finland).

3.2. Policy instruments

Capacity building

State funding for analysis, assessment and research activities is an instrument for supporting policy relevant analyses. The State has funded focused projects exploring aspects of climate change and assessments of vulnerability and risks. In addition, **the Strategic Research Council** and the **Academy of Finland** have funded several programmes and projects exploring adaptation to climate change. The Prime Minister's Office also funds adaptation related research through the Government's annual plan for analysis, assessment, and research instrument (VN-TEAS). Through this funding instrument, several projects, including ELASTINEN, SIETO and KOKOSOPU have been funded, which have contributed to actionable knowledge on adaptation.

The **Climateguide.fi** website is a climate change information portal that brings reliable, research-based information about climate change, its impacts, adaptation, and mitigation. The portal will be financially supported in the coming years as part of the implementation of the 2030 plan. The portal is a national, publicly available digital website that is regularly updated with the latest scientific information about climate change. The data and knowledge provided by the portal is aimed to support decision-making and risk management across sectors, and support climate communication and be a source for learning. The Climateguide.fi website and its main content is maintained by the Finnish Meteorological Institute, the Finnish Environment Institute, and Natural Resources Institute Finland. The website was originally created by the Finnish Meteorological Institute, the Finnish Environment Institute, and Aalto University (YTK Land Use Planning and Urban Studies Group) in an EU Life+ project in 2009–2011.

With regards to the capacity building of the private sector, the role of government is mainly in information dissemination and guidance in cases of e.g., preparing to transboundary risks or ensuring emergency preparedness (Interviews, Finland).

Incentive mechanisms

Overall, financial incentivizing can be carried out through taxation, subsidies, and general funding. Currently there are no financial incentives in use specifically for adaptation. There are sectoral incentives, for example, for agriculture (within the framework of the EU CAP) and forestry (Metka), which contribute to adaptation but are not necessarily intended as adaptation measures (Interviews, Finland). For example, the 2023 NAP contains a goal of mapping the condition of private roads and bridges, funded in accordance with the public funding plan until the end of 2024 (MAF, 2022).

Insurance can be considered an adaptation measure, particularly given that the state has withdrawn any compensation on flood damages (since 2014) and on damages to agricultural crops or forests (2016). Currently, individual house owners, farmers or forest owners are encouraged to take private insurance to cover their losses in case of damages. However, there is no data on what the coverage is and how often compensation is paid.

3.3. Best practices and main challenges

More specific ways to “improve” adaptation at the national/ministerial level could be **establishing positions dedicated to adaptation** specifically or including adaptation into existing positions’ responsibilities, however, ensuring that the responsible people have mandate and resources to coordinate adaptation at the ministry.

With regards to the **integration of adaptation** and other themes, a good development has been framing adaptation as a matter of comprehensive security and emergency supply/preparedness, thus steering adaptation as part of other than adaptation-specific discussions in other administrative branches. On the other hand, including other themes in the 2023 NAP (e.g., biodiversity) ensures that adaptation is part of biodiversity-related discussions, while not being “outsourced” to other ministries and the coordinating Ministry can follow up on that (Interviews, Finland).

At the sub-national level, more dedicated and more active **networks for adaptation**, perhaps, funded or supported ones (as are e.g., mitigation-focused), have been pointed out as a useful tool to further build capacity and steer peer learning (Interviews, Finland).

Similarly, a **comprehensive evaluation of risks**, adaptation and clear responsibilities assignments could be beneficial from the sub-national perspective, as indeed the sequence of responsibilities is not always clear (e.g., heat risks could be first managed by the construction departments and standards, whereas the impacts are already the responsibility of healthcare. Shifting responsibilities due to e.g., healthcare and social services reform also (from municipalities to wellbeing services counties) require further delineation in terms of adaptation (Interviews, Finland). Overall, the delineation of responsibilities could be improved and clarified also in the legal frameworks.

Planning adaptation to be **integrated** as part of sectoral work and decision-making at sub-national level and plans is considered to be working better than e.g., separate adaptation. Separate adaptation plans are at the risk of not being integrated into existing frameworks and processes or being in conflict with other decision-making (Interviews, Finland). According to one of our informants, this is

especially prominent in light of recent health and social care reform, where a major part of adaptation-related functions (rescue services, social and health care) has been transferred from the municipalities to wellbeing services counties. While municipalities' adaptation can now mainly be seen in zoning and land use planning and has already been integrated into it since 2005, further delineation of adaptation-related responsibilities between the municipalities and wellbeing services counties is needed (Interviews, Finland).

In terms of the legal frameworks, the Climate Act from 2015 did not fundamentally change the process or outcomes of the national adaptation plan since the process already existed. The NAP itself is consistent in its approach in **mainstreaming** across the existing planning processes. The Climate Act is a framework law that lays down the obligations to the government to produce more detailed plans for both mitigation and adaptation. In addition to the Climate Act, it is worth noting that there are several adaptation concerns that have been addressed in specific laws, for example, in relation to building codes, land use that have been enacted.

The current NAP only requires actions to be taken by the central government authorities and does not substantially consider the role of the **private sector** in adaptation. In Finland, adaptation has been set to be integrated into the work of administrative branches and sectors. However, it is apparent that there is a challenge of **responsibility division** here and the progress on adaptation mainstreaming varies (Interviews, Finland; Hildén et al., 2022). Since NAS, the approach has been to mainstream adaptation across existing planning and development processes. Each of the interim and final evaluations of both NAS and NAP has highlighted that there are some ministerial sectors where progress has been faster, for example the environment, agriculture and forestry and transport and communications, while there are some sectors within which the uptake of adaptation has been slower, for example, health and economy and employment (Hildén et al., 2022). As the responsibility for implementation is allocated to each ministry with the Ministry of Agriculture and Forestry assuming a coordinating role, there are no mechanisms to accelerate the process. It is within the consideration of each ministry to when and how they incorporate adaptation into their planning and activities.

Furthermore, the past evaluations of the NAP have also stressed that the **allocation of responsibilities** continues to hamper the effective implementation of adaptation. The 2023 NAP addresses this by identifying responsible instances for each of the 24 goals over different time periods (MAF, 2022).

Mitigation and adaptation are reported together annually in the annual climate report that is prepared by the government to the parliament, detailing how mitigation and adaptation have been progressing. But there is no cross-checking of the GHG impact of adaptation measures, nor the climate "proofness" of mitigation measures.

Related to the **absence of financial incentives** from the national to municipal actors, informants pointed out whether it is reasonable to set adaptation goals for municipalities without providing financial support as municipalities do not necessarily continue with the implementation in the absence of resources and raised criticism on the absence of financial steering of the municipalities in the NAP3 and unclear division of adaptation responsibilities at the sub-national level (Interviews, Finland).

4. Iceland

4.1. Governance structure

National adaptation policy-landscape

Iceland is prone to natural hazards and has a long history of managing environmental risks due to its unique geographical position and natural landscape. Yet, while this experience has fostered strong local awareness and capabilities among Icelanders to manage the risks from natural hazards, Iceland remains in its infancy with respect to its preparedness to manage both the near and long-term risks of climate change.

Iceland's climate change strategy published in 2007 included an explicit objective to prepare for adaptation to climate change and led to the creation of a working group that was assigned with the task to compile and summarize the best available scientific knowledge on the likely impacts of climate change on Iceland and to outline policy recommendations for adaptation efforts (Icelandic Ministry for the Environment, 2007) (Interviews, Iceland). However, it was not until in 2019 when a national policy framework for climate adaptation began to be developed with an amendment to the country's earlier **Climate Change Act** (No. 70/2012) which laid down a legal obligation at the foot of the government to produce a national adaptation plan (Alþingi - The National Parliament of Iceland, 2019). Prior to the amendments, the Climate Change Act had entirely focused on policies and action around climate mitigation. The amendment entailed the embedment of a new article that delegated the Minister for Environment, Energy and Climate with the responsibilities to:

- Periodically commission an independent climate risk assessment.
- Supervise the development of national adaptation strategy.
- Present a progress report to parliament on adaptation-related developments and work on a regular basis.

The amendments to the Climate Change Act, however, failed to make any explicit requirements for the conduct of an integrated and forward-looking climate risk assessments or adaptation objectives let alone measures. A year later, the **Icelandic Climate Council** published a landmark discussion paper on climate adaptation which pointed out that Iceland was falling behind on climate adaptation compared to other countries and was one of the few countries that had neither developed a national adaptation strategy nor a national adaptation plan (Sigurðsson, 2020). The discussion paper called for an urgent action from the Icelandic government on adaptation, including the development of a policy framework to underpin the

country's policy and work on climate adaptation.

In response to the discussion paper, the government established a working group with the assignment to develop a proposal for a national adaptation strategy (Interviews, Iceland). Subsequently, a **White Paper on Climate Adaptation** produced by the working group was published in 2021 following a consultation process (Umhverfis- og auðlindaráðuneytið, 2021). The white paper became the backbone for **Iceland's first national adaptation strategy (NAS)** that was published alongside the white paper (Icelandic Ministry for the Environment and Natural Resources, 2021), with the view to underpin a **national adaptation plan(NAP)** that was to follow. The national adaptation strategy sets out the overall aim and guiding principles for climate adaptation work in Iceland, as well as distils a number of sector-specific objectives on adaptation. The strategy stresses the importance of climate adaptation to be embedded into all decision-making across authorities, businesses, civil society, and the public, and called on stakeholders across economic sectors to raise awareness and carry out risk assessments in relations to consequences of climate change. Importantly though, the strategy failed to assign any official roles and responsibilities across public and private sector against these actions (Interviews, Iceland). Later that year, a national adaptation plan was enshrined in a partnership-agreement that was jointly signed by a newly elected government coalition at the time (see box 4.1).

Box 4.1. The process of developing Iceland's NAP

In October 2022, the Government established a steering group which was assigned with responsibility to develop proposals on the substance and the framework for the country's first NAP (so-called NAP preparatory phase) in line with the national strategy and in consultation with expert authorities and key stakeholders. The steering group includes representatives from the Icelandic Meteorological Office (Icelandic Met Office), the Association of Local Authorities, the Confederation of Icelandic Enterprise, and the Icelandic Youth Environmentalist Association (Interviews, Iceland). A private consultancy was also commissioned to organize a series of cross-sectoral and sector-specific consultation workshops with relevant experts and key stakeholders from each sector on the behalf of the steering group, to support the formulation of the NAP proposals (e.g., provision of insights/information and validations of existing assumptions), ahead of the actual development of the NAP itself (Interviews, Iceland).

While the stakeholder consultations workshops were designed to inform and support the NAP preparation by identifying key cross-sectoral and sector-specific climate hazards, exposures, and vulnerabilities, they have also become particularly valuable in context of general awareness-raising and knowledge exchange on climate adaptation between and across ministries and national agencies, as well as across wider stakeholders in Icelandic society. An important part of this work is to identify and designate roles and responsibilities against different adaptation objectives and measures.

Following the consultation process, which is ongoing at the time of writing, the steering group will compile and synthesize the output from the consultations, and subsequently submit a report with recommendations for the NAP to the Minister for the Environment, expected late-summer 2023. At present, it is currently unknown when the development of the NAP will commence and whether a new steering committee will be established for its development, although NAP's inauguration and implementation is not expected to take place until late 2024 or early 2025 at the earliest (Interviews, Iceland). It also remains to be determined how regularly the NAP will be updated or the timeframe for the evaluation of its progress.

As reflected above, the policy cycle from climate adaptation in Iceland has largely been adopted from the EU adaptation policy framework. In this context, the Icelandic government is currently in third stage of identifying adaptation option, after having gone through the first two stages of preparing the ground for adaptation and assessing risks and vulnerabilities to climate change. Therefore, subsequent stages will entail assessing adaptation options and implementing them, as well as evaluating its implementation and compliance (Interviews, Iceland).

Table 4.1: Timeline for adaptation policy in Iceland

Year	Item	Description
2019	Amendment to the Climate Change Act	A new amendment to the Climate Change Act adds an article on adaptation.
2020	The Climate Change Council publishes a discussion paper on climate adaptation.	The discussion paper on climate adaptation calls on the government to produce a policy framework to accelerate climate adaptation work in Iceland.
2020	Working group established on national adaptation strategy	The government sets up a working group with the assignment to develop a proposal for a national adaptation strategy.
2021	National adaptation strategy (NAS) published	The government publishes the country's first national adaptation strategy, alongside associated whitepaper.
2021	National Knowledge Centre on Climate Adaptation	The government establishes the National Knowledge Centre on Climate Adaptation within the Icelandic Meteorological Office (later termed, Icelandic Climate Service and Adaptation Centre).
2022	NAP embedded into a new government coalition agreement	As a new government assumes office, the NAP is embedded into the coalition agreement.
2022	NAP steering group established	The government sets up a steering group assigned with the preparatory work ahead of the NAP development.

Division of responsibility

The legislative power in Iceland is vested in both the Parliament and the President, whereas the Government is the executive authority on implementing legislations passed by the parliament and is responsible for the formulation and implementation of policy on a national level (Prime Ministers' Office, n.d.). On a subnational level, the country has a single tier of local governments, i.e., the municipalities, governed by municipal councils, which are elected every four years (OECD and United Cities and Local Governments, 2016). The municipalities share the same status and responsibilities, which primarily include social welfare, education, traffic and transport, spatial planning, culture, environment protection among other responsibilities. Municipal collaboration takes place through regional boards, regional federations, and economic development agencies co-owned by the municipalities.

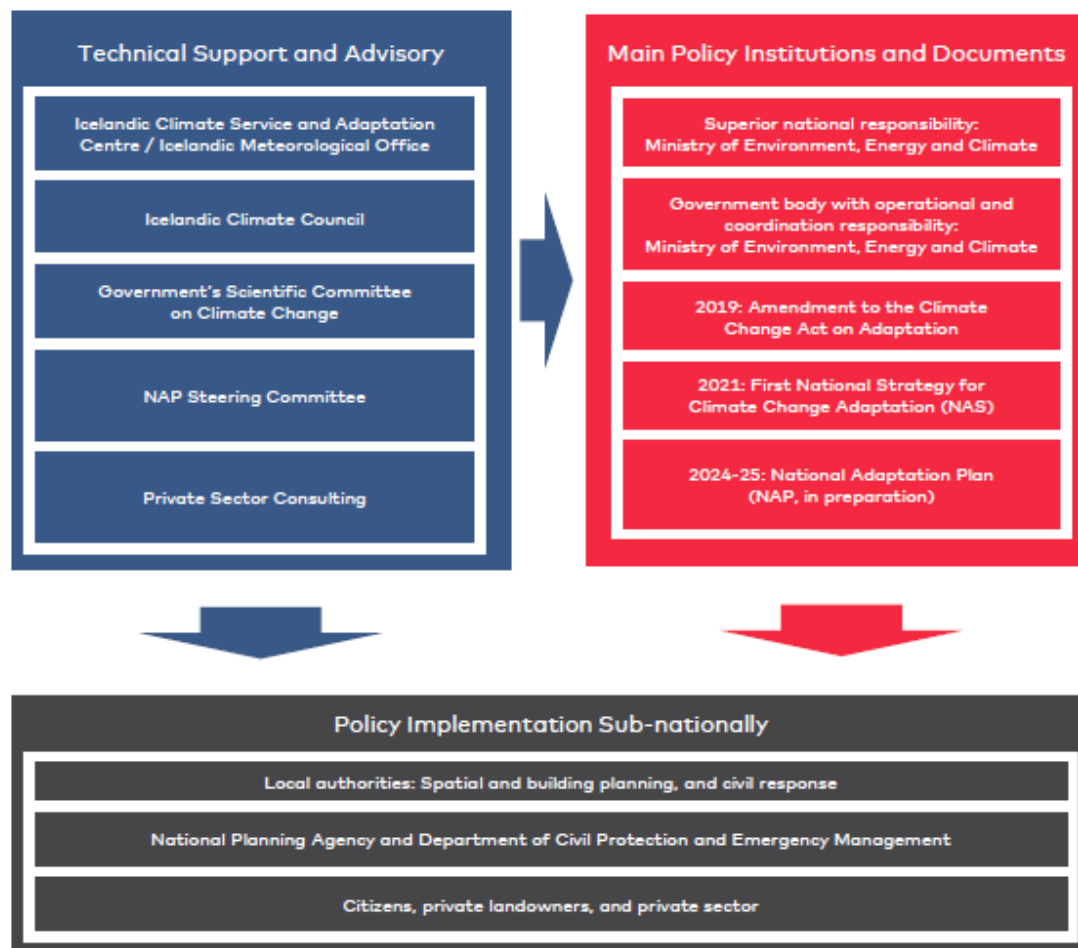


Figure 4.1. Organization of adaptation in Iceland

National

The **Ministry of Environment, Energy and Climate** is responsible for the national adaptation planning and sets the policies to guide the implementation of adaptation measures across Iceland and evaluation of their effectiveness, as stipulated in the Climate Change Act. Accordingly, the ministry is supposed to work in close collaboration with other relevant ministries to enforce the implementation of adaptation measures within their areas of responsibility and mandate, and in line with the national adaptation strategy (Interviews, Iceland). While all ministries have some touchpoints to adaptation policies, formally or informally, the ministries that are assigned with policy portfolios relevant to adaptation work include: The Ministry of Finance and Economic Affairs, the Ministry of Food, Agriculture and Fisheries, the Ministry of Health, Ministry of Social Affairs and Labour, and the Ministry of Infrastructure.

The Ministry of Environment, Energy and Climate had a supervisory role over the national adaptation strategy that it developed in consultation with the Icelandic Climate Change Council, and with the support of relevant national agencies, including the Met Office, the Marine and Freshwater Research Institute, the Environment Agency, the National Planning Agency, and the Icelandic Institute of Natural History. As mentioned above, the Minister for Environment, Energy and Climate is obliged to commission regular analysis of key climate hazards and their impacts on Icelandic nature and society, to be carried out by the IMO in consultation with relevant authorities and experts. The Minister is also required to present a regular status report to the Icelandic parliament matters related to climate change, including adaptation, as set out in the provisions of the Climate Change Act (Alþingi - The National Parliament of Iceland, 2019).

While the Ministry of Environment, Energy and Climate has some responsibilities around monitoring and surveillance of climate related risks, through its mandates around natural hazards and avalanches, the **Ministry of Justice** is responsible for emergency response and thus conducts some mapping exercises of hazards. Under the auspice of the ministry, the **National Commissioner of the Icelandic Police** is involved in some adaptation-related matters as part of its assignment from the ministry to run the country's **Department of Civil Protection and Emergency Management** and is thus responsible for operating national command centre for emergency response (Interviews, Iceland).

Other government ministries with mandates relevant to climate adaptation includes:

- **The Ministry of Health:** The ministry is responsible for the management of the country's public insurance system.
- **The Ministry of Finance and Economic:** The ministry is responsible for the legal framework underlying the country's natural catastrophe insurance system.
- **The Ministry of Foreign Affairs:** The ministry supervises and coordinates the country's work on overseas development (including climate adaptation).

The National Planning Agency has an important role to play for climate adaptation in context of spatial planning, as it is responsible for the administration and implementation of national Planning Act, the Act on Marine Spatial Planning, and the Act on the Environmental Impact Assessment (Iceland, Interview).

Sub-national

While the Icelandic Climate Change Act stipulates that **local authorities** across Iceland's municipalities are obliged to develop their own climate strategy and greenhouse gas emission targets, the act does not make any requirements of the inclusion of adaptation objectives (Interviews, Iceland). Nevertheless, the municipalities have a legal responsibility for city planning which includes environmental assessments, including some climate-related risk analysis. Due to the weak legal underpinning for climate adaptation on municipal level, much of the attention and work on climate adaptation has hinged on the political interest and will of municipal authorities at any given time. The municipal authority that has been the most proactive in the climate adaptation areas has been the **City of Reykjavik**. This has been the case because of a strong and broad political interest in climate change in recent years, but also the unique institutional capacity and resources of the country's capital to develop a coherent climate strategy and implement adaptation measures. In 2021, the City of Reykjavik published a **Climate Strategy** for the period of 2021–25 (Reykjavíkurborg, 2021). While the main objectives of the strategy were largely related to mitigation (e.g., walkable city, green structures, and a circular economy), adaptation was highlighted as cross-cutting consideration that should be considered across all six of its objectives. Furthermore, the strategy listed eight adaptation-oriented action points which largely focus on the incorporation of climate risks and various adaptation measures (e.g., flood controls and nature-based solutions) into urban planning (see box 4.2).

Box 4.2. Climate change adaptation at the local level: the City of Reykjavik

In 2014 a government coalition agreement for the City of Reykjavik stipulated a plan to formulate a comprehensive climate adaptation policy for the city. The **City of Reykjavik** published its first **climate strategy** in 2016 which included two explicit objectives on climate adaptation and a directive to establish a working-group to develop measures around prevention and adaptation in response to the increasing threat from climate change (Reykjarvíkurborg, 2021). The objectives focused largely on mapping key risk areas - including a survey of high-risk flood areas to be incorporated into spatial and infrastructure planning, and the implementation of nature-based and technological measures to reduce flooding risks. The City of Reykjavik also joined the **Covenant of Mayors** and **Mayors Adapt**, which subsequently became the catalyst for the city's work on climate adaptation policy and associated strategy that was inaugurated in 2017. Guided by the work of the European Environment Agency, the City of Reykjavik began to integrate mitigation and adaptation policies, monitored and evaluated under the Global Common Reporting Framework under the Covenant of Mayors through CDP (Global Covenant of Mayors for Climate and Energy, 2018). The city has also sought to obtain a certification on resilience from BREEAM (Bre Group, n.d.).

Reykjavík's climate strategy for 2021–25 stipulates the requirement to incorporate a risk assessment on rising sea-levels into city planning. In this context, the City of Reykjavik has begun to incorporate rudimentary data on flooding risk from rainfall and rising sea-level into its open-access internet tool, **City Web Sight**, which provides various types of geographical information about Reykjavik and its surrounding area. The online tool provides comprehensive visual data on urban division, streets and paths, demographics and real estate, measurement points, natural heritage, and traffic services, to name a few. The City Web Sight plays an important role in aiding the incorporation of risk data around flooding in decision-making around spatial and building plans.

Policy themes

In a report published by the Icelandic Government's **Scientific Committee on Climate Change** in 2018 on climate change and its consequences for Iceland, several climate risks were underscored as being of particular concern in the domestic context - having already begun to materialize, such as implications of increased precipitations and rainfall, flooding and storm frequencies on roads, transmission lines and other infrastructure (Björnsson, o.fl., 2018). The report also raised concerns over the risks of landslides and mudslides, permafrost melting on mountain slopes and glacial retreats, and their implications for villages and rural settlements (see box 4.2 below). The increased risk of wildfires because of increasing droughts was also noted. Similarly, a white paper produced by the Climate Council in 2021 which enumerated seven climate hazards that were of relevance for Iceland, which are the following (Sigurðsson, 2020):

1. More frequent vegetation and forest fires as result of increasing droughts and their implications for human lives, buildings, and infrastructure.
2. Increased flooding risk due to greater precipitation intensity and their implications for infrastructure and furnishing.
3. Increased flooding risk from rising sea levels and their implications for infrastructure and settlements.
4. Increased risk to transport infrastructure (e.g., roads and bridges) from changing riverbeds stemming from shrinking glacial volume.
5. Increased risk from disease transmission and allergen exposure from invasive species, as a result from warming climate in Iceland.
6. The effects of thawing permafrost on the frequency of landslides and mudslides, and their consequences for human lives and infrastructure.
7. The risks from ocean acidification and warming on marine ecosystem and fish migrations, and their implication on the Icelandic fish industry and its revenues.

The Icelandic public officials and policy advisors we consulted highlighted many of the same themes as the ones above, with a special emphasis on flooding and mudslides and ocean acidification. They also pointed to areas which they perceive to be of significant threat to Iceland in the years to come.

One of these is **glacial melt and retreat**, which has been a subject of attention in the context of Iceland's sizable tourism sector as the Icelandic glaciers have been a strong attraction for both foreign and national tourists. Furthermore, climate change-influenced glacial retreats along with permafrost melting could also pose a significant risk to the tourism industry as these can leave behind newly unbuttressed slopes that are unstable and of heightened risk of landslides (Interviews, Iceland).

Government officials and climate policy experts have also consistently highlighted **transboundary climate risks (TCR)** as a serious concern for Iceland and a major blind spot for Icelandic authorities – particularly in relations to implications for trade due to country's high import reliance but also regarding human migration and tourism (Interviews, Iceland). In 2021, a report published by the National Security Council under the auspice of the Prime Minister's Office raised concerns over the transboundary impacts on Iceland's food security and political stability in vulnerable countries with implications for human migration (Þjóðaröryggisráð, 2021). The report also outlined some policy recommendations to address these risks. The national adaptation strategy also stressed the importance of TCR and their implications on human migration and Iceland's tourism sector (Icelandic Ministry for the Environment and Natural Resources, 2021). Despite the concerns raised over transboundary climate risks in these reports, few if any assessments have been carried out to gain better understanding of Iceland's exposure to transboundary effects of climate change and no adaptation measures have been implemented to reduce these risks at present.

Risk assessments

Even though the government's **Scientific Committee on Climate Change** produced a **preliminary climate risk assessment** which importantly identified many of the key climatic drivers facing Iceland and their consequences on the country's ecosystem and society (Björnsson, o.fl., 2018), the risk assessments that have been carried out on the impacts of climate change in Iceland to date, have neither been comprehensive, integrated nor detailed in most cases. Most of the risk assessments provide only a snapshot of the current climate hazards, exposures, and vulnerability, but fail to incorporate different climate scenarios. Even the more comprehensive and sophisticated risk assessments for avalanches, mudslides, and landslides, do not take different climate scenarios into account, whereas assessments for other climate risk suffer even more fundamental shortcomings regarding subpar methodological frameworks and indices of measurements.

The **Icelandic Met Office** carries out ad hoc assessments for the Icelandic Avalanche and Landslide Disaster Fund when there is ground for concern over risks from avalanches and landslides to human settlements (Interviews, Iceland).

Furthermore, the Met Office in partnership with the Icelandic Institute of Natural History, collects data on landslide and associated dangers, as required according to national legislation (Article 3, No. 49/1997) on protective measures against landslides and avalanches (Alþingi - The National Parliament of Iceland, 1997). In relation to other hazard and risk assessments, the Met Office establishes links with the municipalities to ensure that they are informed about the work and its progress, as well as to provide feedback (Interviews, Iceland).

The Icelandic Climate Service and Adaptation Centre (ICSA, see below for details), operating within the Met Office, expands on its role in managing surveillance of risks from extreme weather events and natural catastrophes, and regularly conducts and assembles various scenario analysis on the impact of climate change (Interviews, Iceland).

As alluded to earlier, the Icelandic Government has also periodically appointed specific scientific committees, termed **Scientific Committee on Climate Change** (Vísindanefnd um Loftslagsbreytingar), ad hoc, with the role to produce an assessment report to summarize the current state of understanding on climate change and assesses the main climate hazards and exposure to Iceland. The reports also identify critical knowledge gaps and provides guidance on priorities for further research and assessments (Icelandic Meteorological Office, 2022a). The current scientific committee is currently working on a new report that will be published in 2023.

In other words, while there has been some risk- and vulnerability assessments carried out for a small number of climate-related hazards in Iceland by the Met Office, there have not been conducted any integrated or detailed climate risk assessments against different future climate scenarios. In fact, the Met Office as part of a broader working group, recently published a **Green Paper on Natural Hazards** that stressed the urgent need to incorporate different climate scenarios into risk assessments, as existing risk assessments only provide a snapshot of the current climate-related hazards, exposure and vulnerabilities facing Iceland (Icelandic Ministry of the Environment, Energy and Climate, 2023)

As in other Nordic countries, the **municipalities** in Iceland are in many ways best placed to carry climate risk assessments, both with respect to the responsibilities of the local authorities to ensure the safety and security of its citizens, as well as their proximity with the areas of impacts from climate change. The municipalities indeed conduct some risk assessments that are relevant for climate adaptation as part of their work on spatial planning and in context of civil protection (Interviews, Iceland). For instance, the City of Reykjavik procured an external consultant agency to conduct a high-level analysis of key climate hazards and adaptation options in 2017 (Alta, 2017), in line with the Mayors Adapt requirements and expanding on the national risk assessment carried out earlier by the Government's scientific committee. As mentioned above, the Ministry for Environment, Energy and Climate is leading a pilot project in partnership with the Met Office, Icelandic Regional Development Institute, and the National Planning Agency (as implementing bodies), where five municipalities have been selected to receive funding and support to develop their own local climate risk assessments, as well as a small-scale adaptation strategy. The project will also bring together other relevant ministries, the municipal authorities, as well as the Icelandic Association of Local Authorities and the Department of Civil Protection and Emergency Management,

with the aim to establish an institutional framework and toolkits for municipalities to adopt to adopt for future climate adaptation work.

Systems for monitoring, reporting, and evaluation

There is no formal reporting system or systemic collection of information being conducted on climate risks and adaptation measures in Iceland. However, the consultation workshops conducted as part of the NAP development have played a critical role in providing valuable insights and a broad overview on some of the adaptation work that is underway across the public and private sector.

4.2. Policy instruments

In absence of a NAP, the policy instruments available to support climate adaptation work are few and relatively untargeted. Although policies and other efforts on climate adaptation have seen significant progress in only the last few years, much of the focus thus far has been on developing knowledge inventory on climate adaptation and awareness-raising activities. As such, dedicated financial resources for climate adaptation are limited and incentive mechanisms are few if any.

Capacity building

The establishment of the **Icelandic Climate Service and Adaptation Centre (ICSA)** within the Met Office in 2021 was a significant milestone for climate adaptation in Iceland, as it created a much-needed domestic platform to facilitate awareness raising and knowledge exchange on climate adaptation. Modelled on existing European knowledge hubs on adaptation, ICSA centre operates under the auspice of the Ministry of Environment, Energy and Climate and provides the Icelandic Government and its Scientific Committee on Climate Change (see details, below), with important support for its policy and actions on climate adaptation, alongside its work on climate hazards and risk areas (Icelandic Meteorological Office, 2022b).

The **Icelandic Climate Council**, formed by the Climate Change Act, on the other hand, is an independent advisory body with an assigned responsibility to provide expert advice on climate adaptation to the government and to evaluate the government's adaptation plans in the early stages of the preparations (Loftslagsráð, n.d.). In addition to supporting the government's work on adaptation, the council has an important role in building a knowledge inventory on climate adaptation through the collection and consolidation of research and assessment from relevant expert authorities across the public and private sector. The council also proactively engages in awareness-raising efforts and facilitates knowledge exchange among the public, businesses, civil society, and local authorities.

As mentioned above, the government's **Scientific Committee on Climate Change** has also played a key role in catalysing the momentum for climate adaptation when it published its preliminary climate risk assessment in 2018 (Björnsson, o.fl., 2018). The committee is appointed by the Minister for Environment, Energy and Climate and is assigned with the responsibility to compile and assess the current knowledge on climate change and its impact on Iceland, as well as identify knowledge gaps and research priorities (Icelandic Meteorological Office, 2022a). As mentioned above, the committee is currently working on a new report on the consequences of climate change in Iceland.

The **National Knowledge Network for Climate Adaptation** launched by the Ministry of the Environment, Energy and Climate in 2022 was an important milestone. The network's main purpose is to strengthen knowledge exchange and partnership building around climate adaptation between the government, national agencies, and local authorities, with the view to construct a better national overview and collective understanding of known climate risks and existing knowledge gaps, as well as to improve the visibility of adaptation efforts underway in Iceland (Umhverfis-, orku- og loftslagsráðuneytið, 2022). The forum brings together experts from key institutional bodies, including the Met Office, the Environment Agency of Iceland, the Marine and Fresh Water Research Institute, the Icelandic Institute of Natural History, and the Government's Directorate of Health of Iceland. The forum is also expected to serve as an important function to compile information, develop expertise and establish a strategic stakeholder network around climate adaptation, through both cross-sectoral and sector-specific seminars and workshops (Interviews, Iceland).

Incentive mechanisms

Aside from the government's assignment to the national agencies to ensure that their strategies and work are aligned with the aims and objectives of the national adaptation strategy, there are not many tangible incentives and instruments to ensure that climate adaptations measures are being implemented to any significant degree or at scale (Interviews, Iceland). At present, most funding instruments and economic incentives that the government has put in place have been centred on decarbonization and other mitigation work. As such, the funding resources available to support climate adaptation in Iceland are few and modest.

The Icelandic Centre for Research (i.e. the Icelandic research council) operates the Icelandic Climate Fund under the auspice of the Ministry of Environment, Energy and Climate, which has modest financial resources for climate adaptation related work in the past, but the funding programme for 2023 has been entirely earmarked for work related to emissions reduction efforts (Loftslagssjóður, n.d.). The **Icelandic Avalanche and Landslide Fund (Ofanflóðasjóður)** funds research into landslides with the view of surveying landslides in the country and assesses the characteristics

of the most common types of avalanches (Icelandic Institute of Natural History, n.d.). The fund also provides financing for new protective infrastructure and measures against avalanches and landslides and maintenance of existing ones (Interviews, Iceland). A temporary authorization has allowed the fund to be used to procure risk assessments for climate-related hazards. Similarly, the **Icelandic Road and Coastal Administrations** and the **Natural Catastrophe Insurance** body of Iceland (NTI) have also occasionally funded projects related to natural and climate hazards (Icelandic Ministry of the Environment, Energy and Climate, 2023). On the contrary, the Icelandic government has to date not put in place any bespoke financial instruments or other economic incentives for business or households for the purpose of supporting climate risk assessments or the implementation of adaptation solutions. In addition, most of the domestic funds that have been used to fund adaptation related work have match-funding requirements that limit access to adaptation finance for many actors. At the local level, the City of Reykjavik has incentivized and provided support to households and businesses for the adoption of blue-green surface water solutions in new city districts and in cases of renovation of older systems.

4.3. Best practices and main challenges

The policy development on climate adaptation remains in its infancy in Iceland, and as such, efforts on adaptation to date have been significantly hampered in absence of a NAP, to give a clear signal on climate risk ownership and responsibilities on adaptation. In fact, one of the main challenges for the progression on climate adaptation across policy and practice in Iceland, relates to the weak legal basis for adaptation on both national and subnational level at present (Interviews, Iceland).

The weak policy framework for adaptation work in Iceland relates to the fact that the legal mandate assigned to national authorities and municipalities focuses entirely on policy objectives and actions to bring down greenhouse gas (GHG) emissions and carbon offsetting, and the Environmental Agency of Iceland is thus only tasked with the evaluation and compliance around mitigation effort. This **imbalance between mitigation and adaptation policy ambitions** and efforts, is also reflected in Iceland's national climate action plan, also entirely centred on decarbonization and carbon offsetting (Icelandic Ministry for the Environment and Natural Resources, 2020). Although the municipalities have responsibilities for protecting its citizens and conduct spatial planning which include some environmental assessments, the fact that the municipalities do not have legal obligation to prepare for climate change and engage in climate adaptation work, means that municipal actions on adaptation largely hinge on the political interests and will of the municipal authorities at any given point in time (Interviews, Iceland).

Until recently, there has been a limited number of climate change **adaptation experts with the relevant experience**, knowledge, and skills to comprehensively and properly address the risks that Iceland faces from climate change. This limited understanding of climate risks and subject matter expertise is reflected in the different levels of knowledge among government officials, civil servants, and other public sector bodies who are responsible for managing these risks. More broadly in society, there is also generally a lack of awareness and understanding of the consequences from climate change in Iceland, with respect to domestic threats from storms, flooding, and rising sea levels. A commonly expressed concern by policy advisors and adaptation experts has been the lack of understanding of the impacts of climate change on ocean acidification and its implications for marine life, especially given Iceland's economic reliance on the fish industry (Interviews, Iceland).

Because of the recency of the relevant policy framework to support adaptation work in Iceland, municipalities have been struggling in their ability to conduct risk assessments and implement adaptation solutions, especially in absence of any **financial assistance** or practical support for adaptation. Considering the current absence of institutional expertise and capabilities among municipalities to conduct integrated and forward-looking climate risk assessments, capacity building will be a high priority for both national and subnational authorities in the coming years. In fact, there are some excellent opportunities to leverage some of the world-class marine and glacial research capabilities that exists in Iceland to build stronger expertise on climate hazards in these areas (Interviews, Iceland).

The lack of an **integrated approach** on climate adaptation is another considerable hindrance for the progression of climate adaptation work in Iceland. On a governmental level, the integration of climate adaptation across other relevant ministries and related policy portfolios, such as those covering biodiversity, sustainable development, civil response, and emergency management, is limited due to both institutional silos between ministries and capacity constraints. While many ministries have designated policy-leads for climate change matters, their capacity is spread thin and often tilting in favour of mitigation related work. Although some cross-ministry consultation occasionally takes place on an ad hoc basis around cross-cutting and converging topics (e.g., adaptation and nature-based solutions), the mainstreaming of adaptation across the government's wider policy and work does not take place in a systematic manner, at present (Interviews, Iceland).

Yet, there has been a growing awareness among national authorities and other key stakeholders in recent years on the importance of an integrated approach to climate adaptation and thus the forthcoming NAP is expected to address the issue of mainstreaming adaptation across the government's wider policy and work. On a municipal level, the City of Reykjavik does (both mitigation and adaptation) across

different policy and sectoral domains. As an example, the unit within the city authority that is responsible for managing the CityView interactive mapping tool is required to consider and embed climate related information into their work, whereas the city officials working with the municipality's schools are required to consider resilience aspect in the built environment to ensure alignment with the requirements of the BREEAM certification. The Met Office also takes an integrated approach towards climate adaptation and adopts a cross-disciplinary process with respect to stakeholder consultation and wider evidence gathering (Interviews, Iceland).

Finally, climate risks are largely approached from a domestic perspective in Iceland and has thus far not assessed the impacts of **transboundary climate risks** to the country's economy and wider society. For instance, there is insufficient contingency planning and anticipatory policymaking to anticipate the challenges from climate-related human migration and populations displacement, but this is an area that is likely to become of increased concern on the subnational level as the national government usually needs to negotiate with the municipalities around the settlement of refugees. Similarly, there has been a lack of assessment carried out to assess the country's exposures to climate-related shocks through its trade channels, in particular in context of import reliance and its implications for food and other commodity-security.

In summary, a slow progression around climate adaptation over the years in Iceland has stemmed from its absence in the political and public discourse, resulting in the lack of political ownership, which in turn, has hindered the acknowledgement of these risks both horizontally across different ministries and veridically across the national and subnational level, as well as across society at large. Nevertheless, there has been a watershed change in the level of awareness around climate adaptation only within the last year, largely due to the preparatory work that is underway ahead of the development of the NAP work, such as the stakeholder consultation workshops (Interviews, Iceland), as well as the important advancements of the work by the Climate Council, Scientific Committee, and the Met Office/ICSA that is taking place in tandem with the NAP development. The inauguration of the NAP will play a pivotal role in further raising the importance of climate adaptation and making it more salient in the wider societal sphere. However, only time will tell if the growing awareness of climate risks both domestic and transboundary will translate into serious policy ambitions and resources to deliver effective adaptation.

5. Norway

5.1. Governance structure

National adaptation policy-landscape

Norway is a country of high geographical diversity and challenging weather conditions. As a result, Norway has a long a history of adapting to both weather and climate and to plan for and respond to natural hazards. In practice, Norway has been adapting to the effects of climate change significantly longer than the official strategies and laws indicate. Much of this work has been done at the local level, and to this day the local authorities are the ones with the central responsibility for implementing and monitoring adaptation measures. The first explicit adaptation measures in the early 2000s were thus taken at the local level, with some municipalities introducing adaptation measures and some county authorities adopting climate plans.

At the national level, climate change adaptation has been on the political agenda since the early 2000s with a steady increase in focus during the 2000s and increased manifestation in strategic documents during the 2010s (see timeline below). In 2008, the Ministry of Environment published its first national policy document on climate change adaptation (although not issued as a formal policy note). The document, which outlined the preliminary basis for a national adaptation strategy, established adaptation as a policy area on the national climate policy agenda. Until then, adaptation was only addressed to a limited extent within particularly affected government sector bodies, such as the Norwegian Water Resources and Energy Directorate (NVE). This initial adaptation strategy document led to the establishment of a public committee on climate change adaptation later in 2008, which in 2010 presented a **Government Green Paper** on climate change adaptation. The Green Paper pointed at the importance of developing national policy and government support towards other actors involved with climate change adaptation (Norwegian Ministry of Climate and Environment, 2010). This work culminated in 2013, when Norway got its first formally adapted **National Adaptation Strategy (NAS)** in the form of a **Government White Paper**. NAS lays down the central principles and conditions for adaptation (Norwegian Ministry of Climate and Environment 2013), namely (see also the section on responsibility below):

- Everyone has a responsibility to adapt to climate change, including individuals, businesses, and authorities.
- The government has the overarching responsibility for ensuring that all actors can perform their responsibility for climate change adaptation in the most efficient way possible.
- The government must also facilitate conditions for good cooperation across sectors and levels of authority.
- The municipalities have a special responsibility for identifying needs and implementing adaptation measures locally as the authority with closest proximity to the climate change impacts.
- Climate change adaptation must be based on the precautionary principle, in the sense of taking as the foundation the highest alternatives from the national climate projections when the consequences of climate change are assessed.
- Climate change adaptation necessitates balanced considerations, in the sense of balancing adaptation needs against other important societal considerations in each individual case.

The first steps toward establishing a **legal framework** on climate change adaptation in Norway were taken as part of the follow-up of the national policy document from 2008. These steps included enabling the county governor to object to local spatial plans if natural hazards were not considered sufficiently, making climate change adaptation an official responsibility of the county governor, incorporating adaptation into national requirements for municipal and regional planning, and implementing the new **Civil Protection Act**, which among other things requires municipalities to carry out sector-wide risk and vulnerability analyses and develop security targets and strategies in response to natural hazards.

Norway got its first overarching legally binding document on climate change in 2017 with **the Climate Act**. While not being predominantly about adaptation, the Climate Act requires the Government to report to the Parliament every year on how Norway is preparing for and adapting to climate change.

The Planning and Building Act is of general importance for the work on climate change adaptation. Originally the Ministry of Environment was responsible for the aspects pertaining to planning, but in 2014 this responsibility was transferred to the Ministry of Local Government and Regional Development (MLGRD). In 2018, the Council of State introduced the Central Government Planning Guidelines concerning guidelines for the planning of climate, energy, and climate change adaptation. The guidelines require that municipalities, county municipalities and the state contribute to society's preparedness for and adaptation to climate change through planning and other governmental and business activities. The guidelines put emphasis on the sub-national level by underlining that climate change

adaptation should contribute to society's ability to face climate change, by ensuring that municipalities and county municipalities avoid or limit risks, vulnerability, and disadvantages, and take advantage of any benefits resulting from changes in the climate (Norwegian Ministry of Local Government and Regional Development 2018).

As adaptation in Norway is guided by a sector-principle of shared responsibility (see section below), regulations on adaptation are found in a wide range of documents, pertaining to different sectors and types of authority. Besides the national strategy and plan, most sectors have their own sector documents that inform adaptation. For the Norwegian Environment Agency (NEA), for instance, adaptation is also informed by the **2015 Government White Paper on biodiversity** (Norwegian Ministry of Climate and Environment 2015) and the **2016 Government White Paper on outdoor recreation** (Norwegian Ministry of Climate and Environment 2016). In addition, NEA has its own strategy for climate change adaptation (Norwegian Environment Agency 2018), which is to be updated during 2023.

Adaptation strategies and plans are thus far not structured within a set policy cycle but are being revised on an ad-hoc basis. An updated adaptation strategy in the form of a new Government White Paper is presented in June 2023.

Table 5.1: Timeline for adaptation policy in Norway

Year	Item	Description
2003	Government White Paper	First mention of climate change adaptation in a Government White Paper (Meld. St. 39, 2003–2004, on civil protection)
2007	Government report	Report based on the inputs from a 2005 inter-ministerial seminar on climate change adaptation
	Governmental monitoring report	First governmental monitoring report on climate change adaptation efforts (limited to local civil protection work, issued by the Directorate of Civil Defence)
2008	National policy document on adaptation	First national policy document on climate change adaptation issued by the Minister of Environment, considered to be the frontrunner for the NAS
	Sub-national adaptation strategy	First national strategy on sub-national authority ambitions for addressing climate change adaptation issued by the National Association of Local and Regional Authorities (KS)
	National institutional unit	Establishment of a national climate change adaptation secretariate at the Directorate of Civil Defence (changed to Norwegian Environment Agency in 2013)
	National information service	Establishment of a national web-portal on climate change adaptation (www.klimatilpasning.no) run by the Norwegian Environment Agency from 2013
	Scientific monitoring report	First scientific monitoring report on climate change adaptation efforts (limited to municipal efforts, issued by Norwegian Institute for Urban and Regional Research (NIBR))
2010	Government Green Paper	First Government Green Paper on climate change adaptation (NOU 10, 2010)
	National information service	Establishment of the Norwegian Centre for Climate Services (www.klimaservicesenter.no) run by a collaboration of public and private entities (finalized in 2013)
2013	Formal National adaptation strategy (NAS)	Government White Paper on climate change adaptation (Meld. St. 33, 2012–2013), considered to be the first national adaptation strategy
2017	Law	Adoption of the Climate Act with requirements for yearly sectoral reporting on climate change adaptation
	National institutional unit	Establishment of an inter-directorate coordination group for climate change adaptation, led by the Norwegian Environment Agency and consisting of representatives from 16 public bodies
2018	Government planning guidelines	Adoption of guidelines anchored in the Planning and Building Act introducing a mandatory requirement for municipalities to integrate adaptation within municipal planning
2019	National research centre	Introducing an annual earmarked funding for establishing the National research centre on sustainable climate change adaptation (Noradapt)
2022	National investigation	First national investigation into government authorities' effort to adapt infrastructure and built-up areas to a changing climate, issued by the Office of the Auditor General of Norway
2023	Revised National Adaptation Strategy (NAS)	Revision of NAS in the form of a second Government White Paper on climate change adaptation

Division of responsibility

Adaptation policy in Norway is guided by "the responsibility principle", introduced in the initial national policy document on adaptation from 2008 and carried forward in NAS from 2013. The principle implies that 'everyone' (including individuals, businesses, and all sector authorities) are responsible for adapting to climate change within their area of responsibility. For authorities, this responsibility includes gathering and generating relevant information about risks and adaptation needs, including how climate change will impact their tasks and their ability to enforce rules and regulations, provide services and manage infrastructure (Norwegian Ministry of Climate and Environment 2013). In many respects, this can be considered a mainstreaming approach to adaptation (Interviews, Norway).

The below overview of responsibility at the national and sub-national levels is largely drawn from the website of the Norwegian Environment Agency (n.d.a).

National

The Ministry of Climate and Environment (MCE) has the main responsibility for enabling the government's cross-sectoral work on adaptation. Up until 2014, **the Directorate for Civil Protection (DSB)** worked under the auspice of MCE, with the practical mandate of conducting and coordinating the government work on climate change adaptation. In 2014 this task was transferred to **the Norwegian Environment Agency (NEA)**. As part of its coordinating role, NEA supports MCE in reporting on adaptation in Norway to the UNFCCC and developing national systems for reporting. Among other things, NEA is responsible for the scientific knowledgebase on climate change to be used for adaptation planning and implementation, and for following up local adaptation planning guidelines. Through their overview of adaptation instruments, NEA identifies coordination needs and facilitates further development and joint guidance. As an environmental agency, NEA also has the sector responsibility for adaptation related to a number of areas, such as stormwater. MCE and NEA act as respective coordinators of an **inter-ministerial** and an **inter-directorate working group**, both consisting of members from a wide range of relevant ministries and directorates.

The Ministry of Justice and Public Security (MJPS) is responsible for coordinating work on public safety, which includes managing climate change related natural hazard risks and, to a lesser degree, issues of adaptation. DSB works under the auspice of MJPS to implement policy on the issues of civil protection. DSB is responsible for having an overview of risk and vulnerability in society and has coordination responsibility in the area of social security across administrative levels and sectors. DSB supports the ability of all levels of administration and sectors to account for social security in their planning, and how the current and future climate affects societal risk and vulnerability.

The Norwegian Water Resources and Energy Directorate (NVE), working under the auspice of the Ministry of Petroleum and Energy (MPE), is responsible for preventing physical damage due to floods and landslides. This involves assisting municipalities and society at large with expertise and resources for mapping, spatial planning, security, monitoring, notification, and preparedness. NVE also conducts climate risk analyses and identifies the need for adaptation measures within the energy sector, with an emphasis on systems for hydropower production and transmission networks for electricity. Given the high focus on floods and landslides within Norwegian climate change adaptation, NVE becomes a particularly central player in the planning and implementation of adaptation measures.

Besides these main national authorities with cross-sectoral responsibility, a range of other authorities have adaptation as one of their focus areas, in accordance with the principle of sector-responsibility. For instance, **the Norwegian Building Authority (DiBK)**, working under the auspice of the Ministry of Local Government and Regional Development (MLGRD), is responsible for ensuring that climate change is considered in the construction of new buildings with regards to location and materials (Norwegian Building Authority n.d.). Similarly, **the Directorate for Cultural Heritage (DCH)**, working under the auspice of MCE, is responsible for assessing and reducing climate change risks on cultural heritage sites (Norwegian Directorate for Cultural Heritage n.d.).

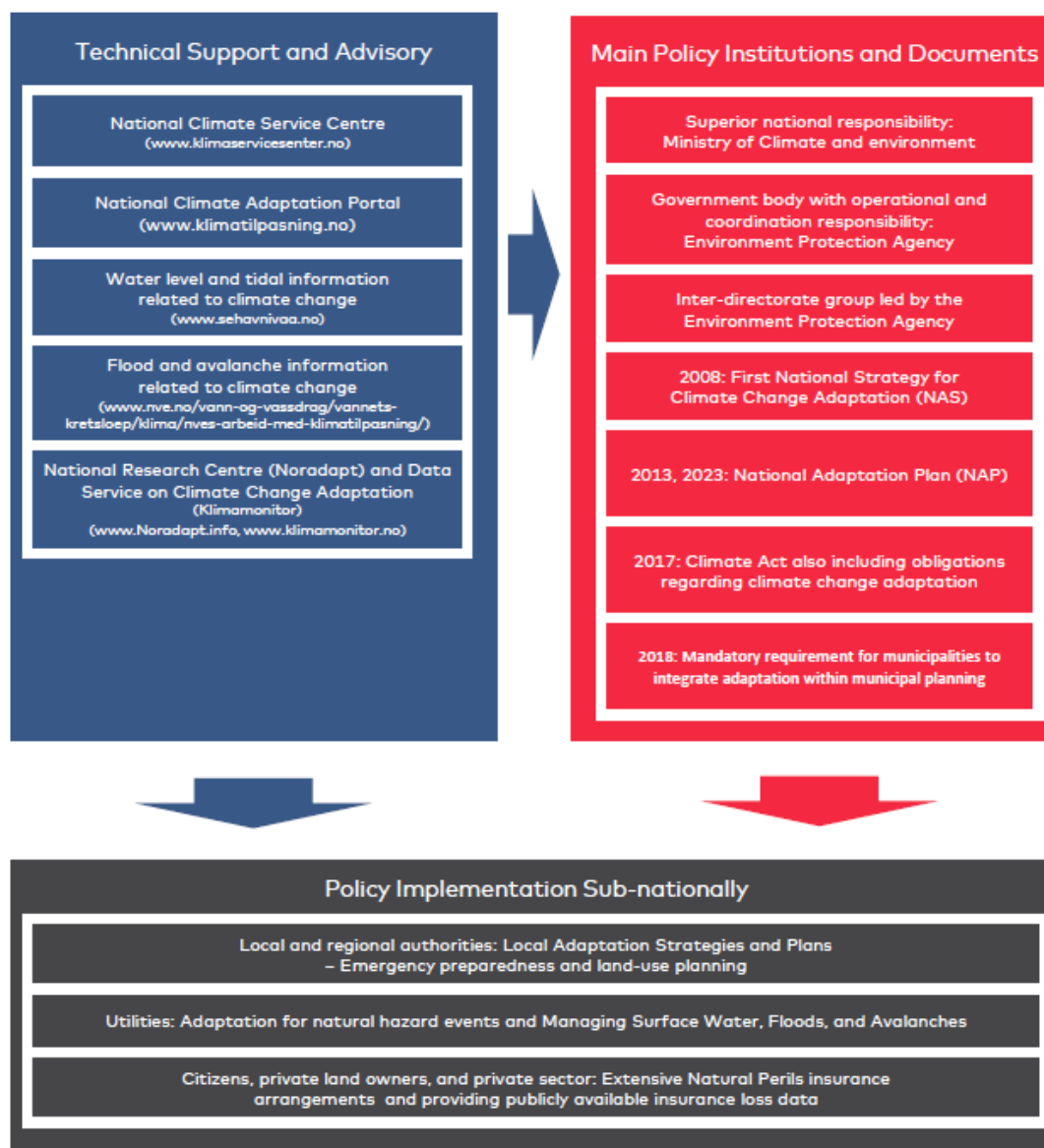


Figure 5.1. Organization of adaptation in Norway

Sub-national

The county governor, the counties, and the municipalities are the most relevant actors for climate change adaptation at the sub-national level. As of January 2023, Norway is structured with 10 county governors, 11 counties, and 356 municipalities.

The county governor is the state's representative in the counties, responsible for following up decisions, goals and guidelines coming from Parliament and the government. The county governor has a mandate to coordinate national climate policy in the municipalities and is an important driver for putting adaptation on the agenda in the municipalities, for instance through exercising their authority to object to municipal spatial plans if climate change adaptation has not been

sufficiently taken into account. A recent survey carried out by the government-funded Norwegian Research Centre on Sustainable Climate Change Adaptation (Noradapt) as part of the service "Norwegian Climate Monitor", shows that 80-90% of the representatives from various county governor departments (incl. civil protection, agriculture, and environment) consider climate change adaptation to be of high priority within their department (Norwegian Climate Monitor 2022a).

The county is the politically elected body at the regional level in Norway. As the regional planning authority in accordance with the Planning and Building Act, the county municipalities also have an important role to play in climate change adaptation. In their capacity as a politically elected body, the county can take a more active role in adaptation than that of the county governor. However, there are considerable differences in how the various county municipalities have utilized their room for action. In some cases, counties have worked in close collaboration with the county governor and municipalities on climate change adaptation through the preparation of regional plans, whereas other counties have taken a more minimalist approach (see box 5.1 below). All counties have developed climate plans that include both adaptation and mitigation. In accordance with the responsibility principle, the counties are responsible for adaptation within the areas of their general responsibility. How and to what degree adaptation is worked with, however, is largely up to the political priorities in each county and therefore varies substantially (Aall et al. 2018).

Box 5.1. Municipal adaptation networks – example from Trøndelag

The Trøndelag Climate Adaptation Network (NKT) was founded in 2017 by Trondheim Municipality, the State Administrator in Trøndelag and Trøndelag County Council with the purpose of creating an arena for cooperation on climate change adaptation in the county across administrative levels to enable climate resilient municipalities.

The network aims to be an arena that motivates municipalities in the region to work on adaptation, and enables exchange of knowledge and experience, contributes to collaboration on adaptation between public and private actors, and supports new expertise on adaptation through dialogue with and use of knowledge communities.

The network makes use of individual visits to the municipalities and regional gatherings. The work is structured using the EU monitoring, reporting and evaluating (MRE) method and focuses on integrating vulnerability analyses and adaptation measures into the ongoing municipal planning work.

Within the first five-year period, the network aimed for its members to:

- Incorporate the development of an adaptation strategy into the municipal planning documents.
- Map vulnerable areas, or areas exposed to climate change, and make concrete plans for adaptation measures.
- Initiate adaptation measures and enable across-departmental organization of adaptation.

A status report from 2021 concluded that much has been learned and much work remains. It finds that particularly the cross-departmental collaboration has increased because of network activities. The report emphasizes the need for continuous networking and support in the years to come.

(Trøndelag Climate Adaptation Network 2021)

The **municipalities** are Norway's local administrative authority and have the overall responsibility for local adaptation planning and the practical implementation of adaptation measures within municipal borders. Ever since climate change adaptation was put on the political agenda in the early 2000s, there has been high expectations for the municipalities' efforts in adaptation work, both from national authorities and from the municipalities' own organization (KS). A total of 12 national surveys of the municipalities' work on adaptation have been carried out since 2007, in addition to several more limited sample surveys. According to the latest national survey (Selseng et al. 2021) about 2/3 of the municipalities consider climate change adaptation efforts to be integrated into the treatment of zoning plans and the municipality's overall risk- and vulnerability analysis to a very large or large degree, and around half of the municipalities have a climate change adaptation plan either as a stand-alone plan or integrated within an energy- and climate plan.

Policy themes

The list of prioritized policy themes has varied somewhat since the initial national policy document on adaptation in 2008. This is mainly a matter of linguistic variations. The updated list on the Norwegian Environment Agency's website includes the policy themes that have been on the policy agenda from 2008 onwards (Norwegian Environment Agency n.d.a):

- Construction of buildings
- Fishing and aquaculture
- Health
- Infrastructure and transport
- Cultural monuments and cultural environment
- Agriculture and reindeer husbandry
- Biodiversity and outdoor recreation
- Civil protection and preparedness
- Water supply and wastewater

Climate change adaptation policy has mostly considered local physical climate risks. However, in 2019, the first designated^[2] official policy report on the policy theme 'transboundary climate risks' (TCR) was presented by the Norwegian Environment Agency (Nordbø et al. 2019), followed up in 2022 by an in-depth study on TCRs related to the Norwegian food system (Bardalen et al. 2022). The theme is

2. The theme of transboundary climate risks has been addressed earlier than this report, however. A background report on transboundary climate risks was published as part of the work on the Government Green Paper on climate change adaptation (Buan et al. 2010). The report gave no clear recommendations about TCRs or how to put the topic on the adaptation policy agenda, but pointed out that "this is a policy field in an early phase" and recommended that "the field thus requires constant updating both empirically and analytically (theoretically)" (p. 62).

receiving a growing interest internationally in adaptation policy contexts, also in the Nordic countries (Berninger et al. 2022). In Norway, TCRs are also increasingly on the radar of local and county authorities. Between 2017 and 2021, the percentage of local and county authorities who considered TCRs to be an important climate risk increased from 15 percent to 40 percent (Selseng et al, 2021)^[3]. In a survey from 2022 to representatives of county-level authorities this share had increased to 95 percent, making it the highest ranking out of nine predefined climate risks (Norwegian Climate Monitor 2022b)^[4]. Our informants confirmed that there is an increase in attention to TCRs and acceptance that this 'new' form of climate risk should be placed high on the adaptation policy agenda in the coming years (Interviews, Norway). In addition to TCRs, adaptation within the private sector is an emerging theme within adaptation policy in Norway.

Risk assessments

Norway does not have a system in place for systematic and periodic production of national climate change risk and vulnerability assessments. At the national level, information on risks and vulnerabilities has been partly covered in the Government Green Paper from 2010, the Government White Paper from 2013, and the report "Climate in Norway 2100" (Hanssen-Bauer et al. 2015), which is limited to describing the hazard-part of the hazard-vulnerability-exposure-risk 'equation'.

Certain government sectors produce their own risk and vulnerability assessments, which to a varying degree include climate risks. For instance, the Norwegian Water Resources and Energy Directorate (NVE) conducts regular risk and vulnerability assessments for the energy sector, which to some degree includes climate change considerations.

The Civil Protection Act from 2010 and regulations on municipal preparedness obligations from 2011 require municipalities to prepare risk- and vulnerability analyses (RVA analysis) and contingency plans for unwanted incidents, including incidents caused by climate change. This requirement also includes the regional level, with the county governor's civil defence department responsible for following up this requirement.

Relatively few studies have analysed the socio-economic consequences of climate change in Norway. The studies that exist indicate that the consequences of up to a 2.5 °C increase in the annual average temperature in Norway towards the middle of the century may be relatively moderate, while a continuation of this trend towards a 4.5 °C increase by 2100 is likely to have extensive negative consequences for the economy, and thus for economic prosperity and development in Norway. There is still little knowledge about how the consequences will be distributed across

3. The two surveys from 2017 and 2021 had responses from 27% and 42% of Norwegian municipalities, respectively.
4. This survey had responses from all county municipalities in Norway.

different economic activities and sectors and how this will play out geographically (Aall et al. 2018). A study from 2021 by NVE found that the direct costs associated with not securing existing buildings against floods and landslides will cost the Norwegian society more than 300 million NOK (26 million Euro) annually, amounting to approx. 6 billion NOK (half a billion euro) for the period 2021-2040 (Kalsnes et al. 2021).

The research institute SINTEF has assessed methods and tools for cost-benefit analysis of climate change adaptation measures used within the Norwegian Water Resources and Energy Directorate (NVE), the Norwegian Public Roads Administration (SVV) and the Norwegian Railway Directorate (JDIR). The assessment shows that current cost-benefit analysis does not consider the expected effects of climate change. The assessment therefore concludes that there is a need for better analysis that can help decision-makers plan effectively and long-term given the expected climatic changes (Seljom, 2021). Another assessment conducted only for SVV had a similar conclusion (Handberg et al, 2020). Based on these conclusions, a project was initiated in 2022 which aims to adapt the cost-benefit analysis method currently used by SVV so that climate change adaptation is considered (Handberg et al, 2023).

Climate change is primarily understood to manifest itself locally, with climate risks resulting from local vulnerabilities. However, as described above, recent years has seen an increased attention to the risks posed by climate change related impacts outside of Norway and transboundary climate risks (TCRs) have thus become a theme in several recent reports (e.g., Bardalen et al. 2022; Berninger et al. 2022; Norbø et al. 2019). In part due to its challenging geographical and political scale, however, this increased concern has not yet been translated into concrete strategies or measures (Aall et al. 2018; Interviews, Norway).

Systems for monitoring, reporting, and evaluation

Norway does not have a designated system for monitoring, reporting, and evaluating (MRE) climate change adaptation. Adaptation is included as one of 24 official national environmental policy goals, which are measured using 82 environmental indicators (Environment Norway n.d.a). The goal pertaining to climate change adaptation ("Society must be prepared for and adapted to climate change") has one official indicator for measuring goal achievement ("Status for the incorporation of routines, measures, strategies, and instruments related to climate change adaptation in central sectors"). However, on the website presenting the Norwegian environmental goals and indicators, it is stated that neither the status nor the development of the adaptation goal is possible to calculate, while the development of the indicator is described as "positive" (Environment Norway n.d.b).

Despite this lack of indicators, adaptation is monitored and reported on to some degree. The Climate Act from 2018 requires the government to present an annual

report to Parliament on how Norway is prepared for and adapted to climate change. They do this based on requested inputs from the various ministries and directorates submitted to MCE. In 2022, the government introduced a new procedure for where the reporting on climate policy to Parliament is to be documented, including a separate chapter on preparing for and adapting to climate change, as an annex to the state budget proposal (the 'government green book'). As from autumn 2022 this will be a separate chapter in the government's annual report to the Parliament on the status of the government's environmental and climate work (Norwegian Ministry of Climate and Environment 2022).

At the county and municipal levels, some monitoring and reporting is occurring through the service "Norwegian Climate Monitor", run by the government-funded Norwegian Research Centre on Sustainable Climate Change Adaptation (Noradapt). Since 2021, Climate Monitor has conducted annual surveys on the progress on climate change adaptation within the public sector, private sector, and households, and published the data for free download on its website. In the absence of a national MRE system, some actors have begun developing indicators for monitoring within their own sectors. In Trøndelag county, for instance, three municipalities in partnership with the county governor and a research institution, have developed their own framework for monitoring adaptation within land-use, buildings, and infrastructure, including the development of indicators for process, action, and results (Sivertsen et al. 2021).

In the 2021 Government White Paper on the plan for achieving the Sustainability Development Goals by 2030 (Norwegian Ministry of Local Government and Regional Development 2021), the government announced that a comprehensive system for measuring and evaluating the effect of climate adaptation measures and efforts nationally, regionally, and locally will be drawn up. In the 2023 instructional letter from the Ministry of Climate and Environment to the Norwegian Environment Agency, the development of an MRE system is identified as a priority (Norwegian Ministry for Climate and Environment 2023).

5.2. Policy instruments

The Government Green paper from 2010 and the Government White paper from 2013 identifies five main categories of policy instruments that are relevant for climate change adaptation (Aall et al., 2018):

- Planning and cooperation.
- Juridical policy instruments.
- Economic policy instruments, covering taxes, duties, and subsidies.
- Physical policy instruments, e.g., the construction of flood or avalanche protection.
- Information and research.

In the following, we focus on information and research as well as juridical and economic policy instruments.

Capacity building

A central aspect of capacity building is to increase the administrative capacity to work with climate change adaptation and increase knowledge about such work within public administration. The knowledge of climate change has increased the past ten years, and according to a mapping of Norwegian climate change impacts and adaptation needs (Aall et al. 2018), this has resulted in increased adaptive capacity of Norwegian society. Lack of knowledge is no longer perceived as a central bottle neck for adaptation. Instead, the report mentions lack of resources and low political priority as important challenges for successful adaptation (Ibid.) (see section on best practices and challenges below).

One of the most central entities for generating knowledge on climate change in Norway is the **Norwegian Centre for Climate Services (NCCS)**, which was established in 2013 by the **Norwegian Meteorological Institute (MET)**, **The Norwegian Water Resources and Energy Directorate (NVE)** and two private research institutes that specialize in climate change research. The centre collects and communicates climate and hydrological data to be used both for practical adaptation measures and for further research on the impacts of climate change on Norwegian society (Norwegian Centre for Climate Services, n.d.). In recent years, the centre has focused on enhancing the accessibility of local and regional climate change projections for direct use by local actors (Aall et al. 2018), including county-level 'climate profiles' (Norwegian Environment Agency n.d.a). Other state entities important for generating knowledge for adaptation include the **Norwegian Mapping Authority (NMA)**, who are in charge of collecting and structuring knowledge on flooding and sea level rise to be used in public management (Ibid.).

To enable collaboration and knowledge exchange between national, regional and local authorities, the network **Nature Hazard Forum** (Naturfareforum) was established in 2017 as a network between the **Directorate of civil protection (DSB)**, **the Norwegian Water Resources and Energy Directorate (NVE)**, **the Norwegian Public Roads Administration (NPRA)**, **the Directorate for Agriculture (DA)**, **the Norwegian Environment Agency**, **Geological Survey of Norway (NGU)**, **the Railway Directorate (RD)**, **Norwegian Association of Local and Regional Authorities (KS)**, **the Norwegian Meteorological Institute (MET)**, and **the County Preparedness Officers** (Norwegian Environment Agency n.d.a).

The Norwegian Environment Agency (NEA) plays a central role in capacity building through offering courses, webinars, and podcasts on adaptation-related themes, often directed at local-level authorities. It also supports knowledge generation through its regular commissioning of reports on a wide range of topics pertaining to adaptation.

The competence on climate change adaptation research has been further enhanced through the establishment of **the Norwegian Centre for Sustainable Climate Change Adaptation (Noradapt)** in 2019, which consists of eight Norwegian research institutions. Noradapt provides science-based guidance for public and private sector actors, user-driven knowledge and assessments, research and development for industry actors, dissemination of research results and teaching through adaptation-related university courses (Noradapt n.d.). The past ten years, the research partners of Noradapt have contributed to a significant increase in knowledge on the challenges and possibilities for adaptation locally (e.g., Vindegg et al. 2022; Selseng et al. 2021; Westskog et al. 2018). Despite the increase in research on climate change adaptation in Norway, it only accounts for a minority of funds used for climate change-related research. A study conducted by the Nordic Institute for Studies in Innovation, Research and Education (NIFU) for the Research Council of Norway showed that research funds used for climate change adaptation in 2017 made up only 2% of the overall effort on climate, renewable energy, and energy transition that year (Rørstad et al. 2019).

The translation and sharing of knowledge on adaptation is partly enabled through networks at various levels. Some are led by the NEA while others are at the county and municipality levels. The NEA-led network "**I front**" (in front) is set up as an arena for knowledge development and skills enhancement among the 13 largest municipalities in the country. The networks aim to contribute to strengthening the climate adaptation work across Norwegian municipalities and at the national level through examples and experiences from the network municipalities. (Norwegian Environment Agency n.d.b). The Norwegian Association of Local and Regional Authorities (KS) leads a **network for municipalities**, which aims at supporting municipalities through capacity building, knowledge sharing and testing out adaptation measures locally (Norwegian Association of Local and Regional

Authorities 2021). Besides the practical work with adaptation, these networks are also focused on process and gaining new understandings among municipal authorities about the need and possibilities for adaptation (Interviews, Norway).

Incentive mechanisms

There are no systematic studies on the monetary amount spent on climate change adaptation in Norway, nor on analysing the prioritization of adaptation compared to other policy areas. However, an investigation into public funds provided for local climate policy measures during 2016–2022 shows that funding for climate change adaptation (47 mill. NOK) corresponds to 3 per cent of the funds set aside for mitigating climate change (1.518 mill NOK) (Norwegian Environment Agency n.d.c). The Norwegian Water Resources and Energy Directorate (NVE) has compiled data on registered needs from municipalities and other local actors regarding local security measures against floods and landslides. According to that overview, the total need in 2021 was 3.903 million NOK (Norwegian Water Resource and Energy Directorate 2021).

An analysis conducted by consultants in cooperation with NVE shows that it will cost between 50.000 and 120.000 million NOK if all buildings that are exposed to landslides, floods, erosion, and quick clay landslides are to be secured. By way of comparison, NVE annually allocates security funds in the order of 280 million NOK (average for the period 2014–2021). As an illustration, with this rate it will take between 177 and 426 years before all buildings are insured against this type of natural hazard event.

In general, no 'negative' economic policy measures, such as taxes, have been established that specifically focus on enhancing climate change adaptation. Norway has established several insurance schemes that apply to natural perils, partly public and partly public-private cooperation, which overall means that Norway has among the best functioning insurance schemes when it comes to making society robust to climate change (Hauge et al., 2020). In Norway, there are three main types of **financial support schemes to compensate for loss** (Aall et al., 2015a).

- **Insurance:** Municipal and county buildings and property is automatically insured against damage from natural hazards through the fire insurance, managed through the Norwegian Nature Damage Pool. Damages not covered by this insurance can be covered through other voluntary insurances. It is not possible to insure roads and sewage systems. In addition, the Directorate of Agriculture has developed a support scheme for crop failures caused by climate events.
- **Discretion grants:** Municipalities and counties that are severely affected by natural damage can get compensation from the state as part of the discretion funds. The scheme is managed by The Ministry of Local Government and Modernization and the county governors.
- **Preventative measures against floods and landslides:** NVE provides assistance to municipalities for the preparation, planning and implementation of preventative measures to reduce the risk of flood or landslide hazards in built areas.

There is little systematic research done on the effect of these instruments, but a report from 2015 on efforts to avoid damages from natural hazards investigated how the insurance policies might affect adaptation choices. The report found that while the Law on Natural Damage Insurance enables homeowners to build back after damages from natural hazards, it does not enable them to build back *better* – for instance in cases where relocation is necessary to avoid damages from future natural hazards (Aall et al. 2015a). This problem is partly resolved in the sense that home insurance from 2018 onwards also covers the property itself. This means that the insurance can, if necessary, cover the expenses associated with moving the home to an area that is less exposed to natural damage, not just the expenses associated with rebuilding the home.

Insurance premiums are not risk-based, entailing a certain element of public solidarity associated with the schemes. But this may change as insurance companies themselves gain a better overview of risk variation, or public information on climate risk becomes better available, supported by the fact that the consequences of climate change materialize in the form of ever-increasing insurance payments. Questions of risk are also relevant in the context of loans (see box 5.2 below).

Box 5.2. Economic incentives for adaptation at the municipal level

The Norwegian Agency for Local Governments is a bank with a public policy mandate from the central government to provide low-cost financing to the Norwegian local government sector. The bank takes an active approach to incentivising adaptation by firstly making publicly available information on local climate risks (both physical climate risks and risks related to climate change mitigation measures), and secondly offering more favourable terms for municipalities that can document that they take climate risk into account (Norwegian Agency for Local Governments, 2022).

The Norwegian Association of Local and Regional Authorities (KS) has proposed a new scheme for insurance and financing of security measures to ensure that reconstruction also takes care of the need for prevention against a changing climate and thus prevent that reconstruction after a natural hazard event only brings the damaged objects back to their original (and climate-vulnerable) state they had before the damage occurred (Local Government Norway, 2015).

In addition, some counties and municipalities have developed their own funding schemes to positively incentivize capacity building on the topics of climate change adaptation as well as climate change mitigation and the protection of biodiversity (e.g., Rogaland County n.d.).

Another important financial instrument is that of **aid**. While the governing documents on adaptation mainly pertain to climate change-related risks and vulnerabilities that occur within the national borders, the effects of climate change in other countries are also considered within Norwegian climate policy. In recent years, a growing percentage of Norwegian aid is earmarked for climate change adaptation. The newest strategy for adaptation through Norwegian aid draws on the SDG goals of reducing climate vulnerability and hunger through five prioritized areas: 1) warning systems and climate services, 2) Nature-based Solutions, 3) climate-adjusted food production, 4) infrastructure and 5) innovative financing schemes (Norwegian Ministry of Foreign Affairs 2023).

5.3. Best practices and main challenges

According to the 2018 mapping (Aall et al. 2018), Norway (as most high-income and high-consumption countries) has a **high adaptive capacity** when it comes to addressing local climate risks. The report ascribes this capacity to well-functioning institutions, good state finances and a highly educated population. Additionally, the report finds that the state sector authorities responsible for the most vulnerable areas of society, such as infrastructure and buildings, have integrated climate change considerations in their strategies and evaluation systems, and the same has happened in municipal planning. Several changes in laws and regulations have been implemented, and state coordination in the area has been strengthened. Overall, this helps to enhance the adaptive capacity of Norway.

Cross-sectoral integration of adaptation appears to function well in some counties and municipalities and less well in others. Generally, the smaller municipalities struggle more with integration due to the lack of human and financial resources. The 2019 mapping report found successful integration to be related to municipalities already working in an integrative way to create synergy and save resources. Another reason is that several municipalities have worked actively with adaptation since the early 2000s and thereby have had longer time to develop appropriate systems for cross-sector integration. The Norwegian Association of Local and Regional Authorities (KS) has been important in supporting this work and has in some cases been critical to the lack of prioritization at the national level (Aall et al. 2018).

Some counties and municipalities have begun working actively with nature-based solutions (NbS) to take an **integrative approach to climate change adaptation and biodiversity loss** (e.g., Rogaland County 2023). The prioritization of NbS is supported through the NEA guide for how to consider climate change in public planning, where it is specified that NbS are to be prioritized whenever possible and that omission of NbS must be justified (Norwegian Environment Agency 2019) The increased focus on NbS in recent years is further supported by the publication of

several studies commissioned by the NEA (e.g., Aanderaa et al. 2021; Magnussen et al. 2017). According to our interviewees at the national level, NbS and other integrative approaches to adaptation will continue to receive increased attention in years to come, including how adaptation, mitigation and the SDGs relate and can be worked with synergistically (Interviews, Norway).

While Norway is well situated to adapt to climate change, whether this adaptative capacity is used to its fullest is another matter. A recent investigation into adaptation of infrastructure and the built environment conducted by the Office of the Auditor General of Norway (OAG) (2022) concluded that "In light of the significant consequences that climate change will have, the National Audit Office considers it serious that the authorities have not secured a sufficient overview and implemented the necessary measures to secure existing buildings and infrastructure. This can lead to unnecessarily high costs for society and can also have consequences for citizens' safety." Furthermore, the report found that the national authorities **lack a sufficient overview of climate change related risks and vulnerabilities** as well as information on the status of adaptation in Norway. The report further identified **weak coordination between national authorities** and the lack of adequate **systems for monitoring and evaluation** as significant challenges to adaptation. Among other things, the OAG recommends that central ministries develop a cross-sectoral plan for adaptation and increase the support of municipal authorities to enhance their ability to map risks and vulnerabilities and plan for adaptation of the built environment (Office of the Auditor General of Norway 2022).

According to one of our interviewees at the local level (Interviews, Norway), **the responsibility-principle**, which represents a mainstreaming approach to adaptation, has both strengths and weaknesses. On the positive side, it has resulted in most ministries and departments engaging with adaptation and considering how climate change might impact their work. However, the interviewee observed that when everyone is supposed to be responsible, there is a risk that no one is responsible. The interviewee suggested that in order for the mainstreaming approach to result in successful adaptation at the local level, mainstreaming needs to be coupled with high political priority (including sufficient and consistent funding schemes) and the responsibility for mainstreaming needs to be situated within the jurisdiction of a central ministry with significant political mandate. According to the interviewee, it is an "impossible task" for the Ministry of Climate and Environment (MCE) and the Norwegian Environment Agency (NEA) to coordinate adaptation under the current conditions, partly due to their somewhat limited political power within government (Interviews, Norway).

Several Norwegian municipalities have worked extensively with adaptation over several decades and developed **best practices for how to integrate adaptation** into their work. Yet, many barriers for adaptation at the local level remain. A recent

report based on interviews with ten Norwegian municipalities has found that the identification of barriers to adaptation among municipalities has increased steadily during the past ten years (Selseng 2023). According to the report, however, this is likely connected to an equal **increase in ambition for adaptation** among municipalities. This further points to the state as an important potential bottle neck for reaching the full potential of adaptation at the local level, which is supported by previous studies (e.g., Vindegg et al. 2022; Aall et al. 2018). The report especially points to the **lack of cross-sectoral coordination at the national level**, which results in sometimes contradicting guidelines. This was also brought up by one of our interviewees (Interviews, Norway), who identified a fragmented responsibility-structure (i.e., the responsibility-principle) and the lack of cross-sector coordination as some of the most significant challenges for municipalities to be able to access the appropriate resources for adaptation (including knowledge and funding).

While much adaptation-related knowledge exists, it tends to be fragmented (a study from 2016 found there to be 84 guides for how to approach adaptation within the built environment alone, see Hauge et al. (2016)). Especially municipalities find it challenging to know where to access the exact information they need in a particular situation (Aall et al. 2018; Interviews, Norway). State-level guidelines published in 2018 have addressed this problem through summarizing adaptation-related knowledge and linking to specific and sector-wise guidelines. It is possible that the experienced knowledge fragmentation could be further mitigated by expanding upon the services offered by existing entities, such as the Norwegian Centre for Climate Services (NCCS), for instance, through functioning as a “help desk” able to redirect municipalities and others to the appropriate entity for help with their adaptation needs (Interviews, Norway).

A related challenge to that of knowledge fragmentation, is the translation of knowledge into strategies and actions. Despite the general increase in knowledge on both risks and vulnerabilities, the 2019 mapping found that such translation remains a challenge. The county authorities have gradually become more proactive in mitigating this challenge through taking on a more supportive role and providing guidance for the municipalities (Aall et al. 2018). The mapping further found a lack of knowledge concerning the need for adaptation within the private sector, with the exception for the sectors that are dependent upon natural resources, such as farming and fisheries (Ibid.).

Several recent reports have been published on the topic of possibilities and barriers for adaptation at the municipal level (e.g., Selseng 2023, Vindegg et al. 2022, Selseng et al. 2021). The studies identify **lack of resources (financial and human)** as a considerable barrier to municipalities in Norway, which results in frustration and resignation among those working with adaptation locally. According to the most recent of the studies (Selseng 2023), the areas where municipalities struggle most

with integration of adaptation is in **economic planning and monitoring**. Adaptation measures are expensive and are often seen to compete with other important societal areas. The municipal informants in the study point to **increasing the priority of adaptation** as opposed to mitigation, developing concrete guidelines or tools for integrating adaptation into economic planning, and to implement adaptation into existing economic planning tools to enable monitoring and evaluation (Ibid). Besides more adequate financing, the informants in the study also called for **more predictable climate politics**, informed by long-term goals and commitments rather than the political priorities of the changing governments (Ibid.).

6. Sweden

6.1. Governance structure

National adaptation policy-landscape

The first important milestone for climate adaptation in Sweden was in 2004 when the Swedish Environment Agency organized a seminar on climate risks and adaptation, which brought together representatives from national and subnational authorities (Interviews, Sweden). The seminar resulted in a strong call for a national strategy on climate adaptation. However, it was not until Sweden was severely hit by cyclone Gudrun a year later, causing significant environmental and economic damage, that the country's vulnerability to extreme weather events and climate change received proper attention in the political and public discourse.

That same year, the Swedish Government appointed a **National Commission on Climate and Vulnerability** to produce Sweden's first report to assess the regional and local impacts of climate change on Swedish society and their economic implications (Swedish Commission on Climate and Vulnerability, 2007). The report that was published in 2007, highlighted the need for a greater engagement from subnational authorities on climate adaptation and called for municipalities to have a central role in adapting Swedish society and economy to climate change. Subsequently, the Swedish Parliament published what was referred to as the **country's first coherent climate and energy policy**, which set out to lay the foundations for future actions to address climate change, including directions on climate adaptation (Government Offices of Sweden, 2009).

However, it was not until in 2018 when the Swedish Government finally published Sweden's first **National Adaptation Strategy (NAS)** (Swedish Ministry of Climate and Enterprise, 2018a), rendering the country a latecomer among EU countries to put in place a policy framework to guide the government's work on climate adaptation. The strategy complemented the **Swedish Climate Act**, the country's first legislative framework for climate policy, which was published a year earlier and was centred on mitigation (Klimat- och näringslivsdepartementet, 2017). The strategy outlined the government's vision to develop Sweden into a long-term sustainable and robust society that can confront the challenges of climate change by reducing vulnerability and take advantage of the opportunities associated, in alignment with the Paris Agreement, Agenda 2030 and the Sustainable Development Goals. The strategy set out roles and responsibilities for climate adaptation across different stakeholders and highlighted priority areas for action and investments for adaptation. The strategy also listed a set of principles that should guide climate adaptation work in Sweden, which includes sustainable development, mutuality, scientific basis, precautionary principles, transparency, among others.

The strategy put in place a five-year policy cycle for the national climate change adaptation work in Sweden to ensure continuity and effectiveness and launched the establishment of the **Swedish Expert Council on Climate Adaptation**. The purpose of the Expert Council is to evaluate the national work on climate adaptation and provide evidence-based advice for the government on how to prepare for a changing climate and advance the work on climate adaptation going forward. The government is currently working on the development of a new national adaptation strategy which will be published in 2023 (Interviews, Sweden). The strategy will to a large degree be modelled on the latest EU adaptation strategy, with respect to structure and thematic division (where relevant), according to one of the interviewees.

The strategy assigns the **National Board for Housing, Building and Planning** with a more prominent role in coordinating climate adaptation for the built environment regarding new and existing buildings in the view of available data on climate hazards and risks, and in conjunction with legislative changes to **Sweden's Planning and Building Act** (2010:900) (Boverket – the Swedish National Board of Housing, Building and Planning, 2018). The role of municipalities was also strengthened through two legislative amendments in the Planning and Building Act and the Land Act (Gram-Hanssen, et al., 2023), which established the first legislative backbone to underpin climate risk assessments. The amendments clarified the responsibilities of municipalities in their spatial planning to assess the risk of damage from climate-related natural events related to landslide, erosion, and flooding and how these can be prevented, as well as enabled municipalities to set stricter requirements to address climate risks in their regulatory plans.

Shortly after the publication of the National Adaptation Strategy, the Swedish Government also passed the **ordinance on Swedish authorities' work on climate adaptation**, which entered into force at the beginning of 2019 (Swedish Ministry of the Environment and Energy, 2018). The ordinance assigned responsibility across 32 national governmental agencies and all of Sweden's 21 County Administrative Boards (CABs) to initiate, support and evaluate climate adaptation work within the remit of their mandate. The ordinance also tasks the authorities to conduct a climate and vulnerability assessment; develop goals and an action plan for their work on climate adaptation. The ordinance on climate adaptation and the National Planning and Building Act together form the legislative backbone for climate adaptation in Sweden. According to Sweden's latest Adaptation Communication to the UNFCCC from November 2022 (Swedish Ministry of the Environment, 2022), there are presently 45 adaptation action plans at national and regional level, covering different sectors and business areas, collectively contributing to the implementation of the national strategy.

Various other national legislations, strategies, and action plans in different sectors in Sweden have significant bearing, directly and indirectly, on climate adaptation implementation in Sweden. The **Swedish Environmental Code** is a legislative

package that covers a number of areas related to climate adaptation, including the protection of human and environmental health against different threats and the preservation of biodiversity (Swedish Ministry of Climate and Enterprise, 2020). The **Swedish National Strategy for Forestry** considers the need for adaptation in the anticipation of increasing risks from climate change (Swedish Ministry of Climate and Enterprise, 2018b), while the **Public Health Agency** published an action plan in 2021 on how it plans to adapt the healthcare system to a changing climate (Folkhälsomyndigheten, 2021). Climate adaptation is also expected to be featured in Sweden's upcoming food strategy (Interviews, Sweden).

Commissioned by the **National Knowledge Centre for Climate Change Adaptation (NKCCCA)** at the **Swedish Meteorological and Hydrological Institute (SMHI)**, the Swedish legal consultancy Delphi recently carried out a mapping exercise to provide a comprehensive overview of the national laws and legislations that could be leveraged or operationalized to support climate adaptation work on national and subnational level (Lundh, Ibold, & Bjurström, 2022).

Table 6.1: Timeline for adaptation policy in Sweden

Year	Item	Description
2004	Swedish Environment Protection Agency's seminar on climate adaptation.	The Swedish Environment Protection Agency organizes the first gathering of key authorities to raise awareness of climate adaptation.
2007	A government commissioned report on climate hazards and vulnerabilities for Sweden is published.	A national commission appointed by the Swedish government publishes the country's first report on climate hazards facing Sweden and vulnerabilities.
2009	Sweden inaugurates its first climate and energy policy.	The Swedish parliament adopts the country's first climate and energy policy framework, which includes directions on climate adaptation.
2018	Sweden's first national adaptation strategy (NAS) published.	Sweden's first national adaptation strategy is published by the Swedish Government, to supplement the mitigation-oriented Climate Act published a year earlier.
2018	Amendments to the Planning and Building Act.	Legislative amendments to the existing Planning and Building Act, provided a clearer guidance and mandate for municipalities to ensure that climate risks related to landslide, erosion and flooding are considered in spatial planning.
2019	Government issues an ordinance on climate adaptation for national authorities and county administrative boards (CABs).	The ordinance on climate adaptation issued by the government strengthens the roles and legal responsibilities for national agencies and subnational authorities to work on adaptation.
2023	Sweden's second national adaptation strategy (NAS) to be published.	The forthcoming national adaptation strategy to be published this year is expected to clarify roles and responsibilities on adaptation and strengthen cross sectoral integration.

Division of responsibility

The Swedish administrative model of governance is divided across the national, regional and local levels (Government Offices of Sweden, 2014). The Swedish parliament (Riksdagen) has the main legislative authority at the national level with the Government responsible for executing the decisions and legislations passed by the parliament. Regional governance is divided across Sweden's 21 counties where regional councils are elected regularly, with healthcare provision being one of the main duties, among others. Each county also has a regional central government authority, known as County Administrative Boards (CAB). On a local level, Sweden consists of 290 municipalities which are responsible for special planning and most public services (e.g., school system and elderly care), through the municipal

councils/city councils, which are regularly elected and govern in accordance with the country's Local Government Act.

National

The Swedish Government and the Parliament are responsible for legislative aspects around climate change adaptation on a national level, in collaboration with national agencies, whereas the Swedish Government is responsible for policy development and implementation.

The **Ministry of Climate and Enterprise** is currently at the helm with a supervisory and coordination role for government's work on climate adaptation policy and work, although each ministry is responsible for managing adaptation issues within their policy portfolio and remits (Interviews, Sweden). As part of this role, the climate unit of the Ministry of Climate and Enterprise oversees a recently established cross-governmental working group that brings together 10–12 civil servants representing different ministries with the purpose of developing a new national adaptation strategy. The ministries that were initially associated with the working group included the **Ministry of the Environment**, the **Ministry of Enterprise and Innovation**, the **Ministry of Health and Social Affairs**, the **Ministry of Justice**, the **Ministry of Infrastructure**, and the **Ministry of Finance**. However, there has however been considerable changes to the governance structures within the government since a new government coalition assumed office, and at the time of writing it remains unclear which of the existing and newly formed ministries will be involved in the working group.

Through the government's ordinance on climate adaptation, the Swedish Government has assigned **national agencies** (e.g., the Swedish National Food Agency, the National Board of Housing, the Swedish Geological Survey, to name a few) and the CABs, to initiate, support and evaluate work on climate change adaptation, within their own areas of responsibilities and within the framework of their assignments (i.e. sectors or regions) (Swedish Ministry of the Environment and Energy, 2018). As part of this assignment, these authorities have also been tasked to develop an action plan for their respective organization/county's work on climate change adaptation. The national agencies and CABs are required to report their work on climate adaptation to **SMHI** on an annual basis, which has been given the responsibility to analyse these reports and submit a summary of their evaluation to the government. SMHI has also been tasked to support these authorities in their work.

Since climate adaptation in Sweden has been strongly underpinned by legislations regarding spatial planning, the **Swedish National Board of Housing, Building and Planning** plays a key role in awareness-raising around climate adaptation in context of spatial planning and the built environment. The national agency is also responsible for ensuring compliance to the legal requirements set out by the Planning and Building Act to consider climate risks in spatial planning and decisions

on new buildings and other constructions.

Sub-national

The **CABs** are Sweden's 21 government authorities that operate at the interphase between national and municipal authorities, where they are responsible for ensuring that decisions from the Swedish Government and Parliament are implemented in the counties and oversee government activities at regional and municipal levels. The county boards are also tasked with various regional responsibilities, such as informing the government of regional needs and supporting regional development, as well as the supervision of inter-municipal and other regional interests. The government's ordinance on climate adaptation provided a much-needed long-term framework on responsibilities and roles, to guide the work of the CABs on climate adaptation. Prior to the ordinance, the CABs were assigned temporary responsibilities and goals around climate adaptation on an annual basis. However, the CABs were significantly hampered in their efforts in this area as the county boards did not receive any substantial support from national agencies, as the latter had no legal obligation to develop adaptation strategies or to implement measures within their sectoral remits (Interviews, Sweden).

The ordinance also tasked the CABs with the assignment to:

- Initiate, support, and follow up the climate adaptation work of the municipalities.
- Analyse how the country and, where necessary, neighbouring countries are affected by climate change.
- Support and follow up the climate adaptation work of regional sectoral agencies.
- Contribute to and produce documentation to improve knowledge and planning, and
- Support the work of river coordination groups.

The ordinance assigns responsibilities for the CABs to both monitor and coordinate climate adaptation work across the county's municipalities in line with the government's ordinance on adaptation, as well as to ensure the harmonization of climate adaptation measures with neighbouring counties and to avoid potential maladaptation (e.g. transfer of climate risks across counties) (Swedish Ministry of the Environment and Energy, 2018). The CABs often support municipalities in their climate adaptation work, such as via seminars and workshops. The CABs sometimes also provide their municipalities with guidance and recommendations around spatial planning matters, and compile data on regional risk from climatic (and non-climatic) disasters, such as flooding and heat.

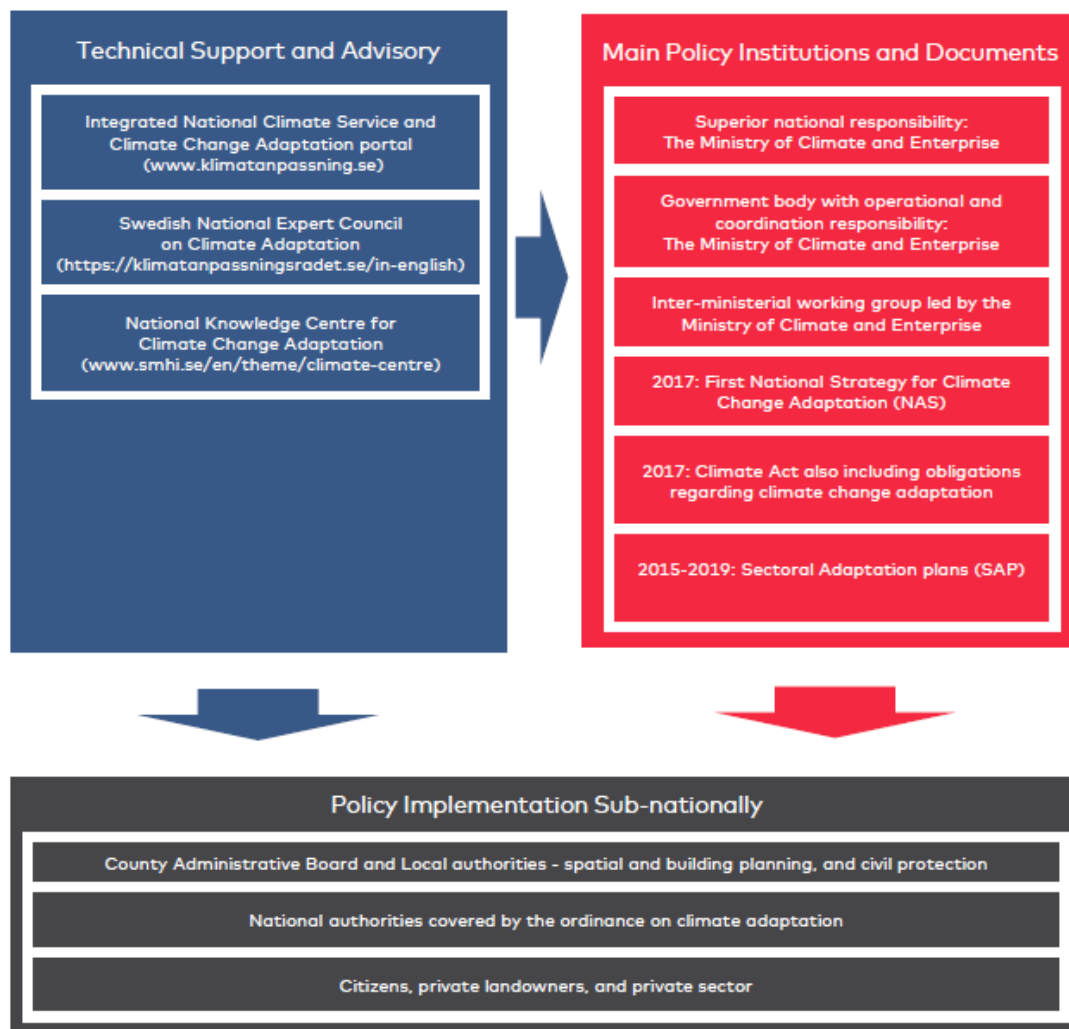


Figure 6.1. Organization of adaptation in Sweden

The **Regional Councils** which are elected every four years in conjunction with the national elections and governed by regional assemblies, however, do not have a statutory role on climate adaptation, according to the government's ordinance on climate adaptation. Still, the regional councils are responsible for a range of critical services and functions that will be affected by climate change, such as healthcare, public transportation, civil response (e.g., carry out regional hazard and vulnerability analyses) and regional development. Therefore, the regions can play an important role in strengthening the climate resilience of these key services and infrastructures and prepare for the impacts of climate change as part of their broader mandates, such as conducting various hazard and vulnerability analyses and healthcare preparedness for heatwaves as part of their role in healthcare provision.

The **municipalities** in Sweden have a central role to play in climate adaptation at a more local level, as considerations of climate risks cut across their existing responsibilities and mandates, such as regarding spatial planning, water management and natural disaster prevention (including various hazard and vulnerability analyses). The legislative amendments introduced by the Swedish Government to the **Planning and Building Act** and the **Land Act** in 2018 (Gram-Hanssen, et al., 2023), granted municipalities with a stronger mandate to ensure that risks from climate change and other natural disasters are factored into permitting-decisions regarding the constructions of new buildings and infrastructures, and spatial planning. Yet, the ordinance on climate adaptation fell short to place any direct legal obligation onto the municipalities to work on climate adaptation, and therefore some municipalities do not have designated individuals or teams work on climate adaptation per se (Interviews, Sweden). The ordinance on climate adaptation regulates the CABs to initiate, support and follow up the work on climate adaptation within their municipalities, but the municipalities are not obliged to report their climate adaptation work to the CABs.

At present, there has not been any clear delegation of responsibility for **private sector** actors on climate adaptation (Interviews, Sweden). While businesses and private property owners have a legal obligation to take actions to manage and protect their assets according to Swedish laws, general awareness among private property owners of this responsibility is limited and its implication with respect to responsibilities of adaptation is unclear.

Policy themes

The current national adaptation strategy highlights seven key priority areas for actions based on forecasted consequences of climate change, including (Swedish Ministry of Climate and Enterprise, 2018a):

- Landslides and erosion that threaten communities, infrastructure, and businesses.
- Flooding that threatens communities, infrastructure, and businesses.
- High temperatures that involve risks for the health and wellbeing of people and animals.
- Water supply shortages for individuals, agriculture, and industry.
- Biological and ecological effects that affect sustainable development.
- The impact on domestic and international food production and commerce, and
- Increased incidence of pests, diseases and invasive non-native species that affect people, animals, and plants.

However, the **Swedish Expert Council on Climate Adaptation** in its first report to the Government in 2022, recommended that the Swedish Government considered the key priority-areas outlined in the strategy within three overarching risk areas to better account for climate risks that are particularly and contextually relevant for Sweden in the forthcoming adaptation strategy, which include 1) physical security and land-use, 2) water security, and 3) food security (**Nationella expertrådet för klimatanpassning, 2022a**). Since it had only been a few months since the current Swedish Government assumed office – at the time of writing, the priority policy areas for climate adaptation for the upcoming strategy remain to be seen (Interviews, Sweden).

Still, according to consultations with public officials and policy advisors, much of the focus of climate adaptation in Sweden to date has been on safeguarding the built environment and other infrastructure against flooding (both coastal and inland), landslides, and coastal erosion, while a CABs and municipalities have been actively working on developing and putting in place cloud-burst strategies on subnational level. In contrast, the use of nature-based solutions (NbS) and broader efforts on safeguarding Swedish ecosystems have been lagging on a national level. However, the county administrative board for Stockholm is currently considering strengthening its work on NbS, for instance on the restoration of wetlands (Interviews, Sweden). According to several of our informants, there is also a strong consensus among government officials and policy experts that transboundary climate risks are a significant threat to Swedish economy and wider society, which has largely remained neglected to date (Interviews, Sweden). Some of the concerns over Sweden's exposure to transboundary climate risks have been raised following

a recent publication that highlighted the country's exposure to risks related to climate-induced disruptions to agricultural supply chains (Lager & Benzie, 2022).

The climate risks and thus priorities for climate adaptation in Sweden also differ to a varying degree across the regions in Sweden. For instance, while flooding risks from rising sea-levels are a particular concern for counties and municipalities in the southern parts of Sweden, such as Skåne, Gothenburg and Stockholm (particularly regarding fresh-water contamination), this is not a risk for counties and municipalities in the northern parts of Sweden which are experiencing land-rise (Interviews, Sweden). The counties and municipalities in the most northern regions of Sweden have also begun to examine the impact of climate change on the indigenous Sami population in Sweden and their livelihood, including reindeer herding.

Risk assessments

The first **national climate and vulnerability assessment of climate change impacts in Sweden** was initiated in 2005 and submitted to the government in 2007 (Swedish Commission on Climate and Vulnerability, 2007). The assessment distilled the methodological approach for the assessment, provided an overview of different climatic drivers and areas/sectors affected, as well as listed several measures to enhance Sweden's climate resilience. In an updated assessment published in 2015 (Andersson, et al., 2015), SMHI compiled evidence about current and future risks and consequences for Swedish society from climate change, and – in partnership with various public and private sector actors - mapped all the key climate adaptation work that had been conducted across Sweden since the publication of the first report. The updated risk assessment also identified existing knowledge gaps and called for clearer and more robust governance structures to provide more knowledge and decision-making support, as well as enable greater access to risk information.

The Expert Council published its **first evaluation of the current state of play of climate adaptation in Sweden**, as assigned by the government, which also provided recommendations on future actions (Nationella expertrådet för klimatanpassning, 2022a). The report provides an analytical overview of how climate change has begun to effect Swedish environment, economy, and society; presents the most up to date analysis on how different sectors have been and will be affected by climate change; assesses the effectiveness of existing adaptation efforts across different levels of governance; and provides guidance to the government on prioritization of future measures to progress the work on climate adaptation. As assigned by the government, the council will publish updated versions of these integrated progress assessments every five years. The report also compiled together some of the available data and information to bridge some of the knowledge gaps identified in the SMHI report.

To date, no climate risk and vulnerability assessment at the national level has been carried out, which accounts for the major climate related risks for different sectors and geographical areas in Sweden under different climate scenarios, highlighting the expected economic impact under the different scenarios, and based on these assessments gives advice on how to prioritize between them. Although the Expert Council has also been assigned with a role to analyse costs for climate risks and adaptation measures on a national level, it concluded that it was not feasible to incorporate such a fully integrated and detailed analysis into its first report due to the lack of available data. At the same time there remains a lack of clarity on the responsibility regarding the conduct of the analysis itself. The Expert Council will in their work up to their next evaluation report examine the council's role in the conduct of an updated national climate and vulnerability assessment, including what it might need other actors to do within the frame of such an undertaking. In general, the risk assessments that are underpinned by legislation or reflected in the adaptation strategy are better developed than others. However, the government's ordinance on adaptation is unclear on the scope and granularity of these sector-specific assessments, as opposed to the strict guidelines for some of the non-climate related vulnerability assessments that already exist (e.g., on disaster risk reductions).

However, the Expert Council recently commissioned a consultancy to conduct a study to assess how cost-benefit analyses have been conducted thus far in climate change adaptation projects in Sweden and to propose a methodology for cost-benefit analysis for climate change adaptation measures, including the monetization of the climate risks and consequences in context of those adaptation measures. The ultimate purpose of this work is to help equip and encourage the use of cost-benefit analysis in decision-making processes on national, regional, and municipal level. One of the main conclusions of this study was that cost-benefit analyses demonstrated economic benefits in implementing adaptation measures in most cases, and especially in context of nature-based solutions. Yet, the findings also showed that cost-benefit analyses are rarely undertaken in general (18 analyses between 2006 and 2022), and mostly in context of risk assessments around flooding. The report further showed that cost-benefit analyses typically focus on consequences that are easy to quantify and that few include discussions about responsibility and funding issues. Still, the report concluded that in most cases investments in climate change adaptation are profitable (Nationella expertrådet för klimatanpassning, 2023).

Alongside the more high-level integrated assessments of climate hazards and vulnerabilities, the national agencies and CABs that are subject to the government's ordinance on climate adaptation, are required to develop regional and sector-specific climate and vulnerability assessments, and report to the SMHI and the ministry responsible for the climate-related policy portfolio (see box 6.1).

Box 6.1. Sector-specific risk assessments in Sweden

- The **Swedish Forest Agency** published a national action plan in 2019 on climate adaptation for Swedish forests and forestry (Skogstyrelsen, 2019). The report included a vulnerability assessment of the impacts of climate change on Swedish forests and forestry and outlined proposals of short- and long-term adaptation objectives, and recommendations of adaptations actions.
- The **Swedish Geotechnical Institute** and **MSB** has similarly carried out a risk assessment to specifically examine the effects on climate change on regional risks of landslides, mudslides, erosion, and flooding, as well as their implication for human health, ecosystem, and infrastructure (Statens Geotekniska Institut and Myndigheten för samhällsskydd och beredskap, 2021). The assessment also outlined preventative and mitigation measures to adapt to these risks. MSB has also conducted important work around climate-related natural hazards and preventions in the context of civil response and emergency preparedness, and thus carries out some assessments on climate-related hazards, albeit more in the context of existing risks.
- The **Swedish Agency for Marine and Water Management** and the **Swedish Energy Agency** are also among other national agencies that carry out risk assessments within their own remits and sectors (Interviews, Sweden 1). However, the government's ordinance on adaptation failed to provide any steer on the scope and granularity of these sector-specific assessments, as opposed to the strict guidelines for some of the non-climate related vulnerability assessments that already exist (e.g., on disaster risk reductions).

Much of the climate adaptation work that takes place on a municipal level is carried out in context of civil response and emergency preparedness. At the same time, there are ongoing discussions on the scope of hazards and vulnerability assessments carried out by the CABs; whether these should cover regional risks or simply risks related to the remits and operations of the CABs. The SMHI is currently working with the CABS, to develop a methodological framework to help with the coordination of the risk analyses across the 21 county boards (Interviews, Sweden).

Systems for monitoring, reporting, and evaluation

There is not currently a comprehensive system for monitoring, reporting and evaluation (MRE) in place in Sweden. The government tasked **SMHI** to develop a proposal for a system for monitoring and evaluation of the national climate change adaptation work, in accordance with the adaptation strategy (Sjöström, 2021). While SMHI submitted its proposal to the government in 2020, no decisions have been made based on the proposals and thus a formal national system for monitoring, reporting and evaluation remains absent.

However, the national authorities covered by the ordinance on climate adaptation and the CABs annually submit their statutory climate related hazard and vulnerability assessments and reports on their adaptation work to SMHI, which is responsible for their collection, analysis and synthesis. Subsequently, the SMHI submits a summary report of their evaluation of this work to the government. SMHI operates a system for the monitoring and evaluation of climate adaptation work in accordance with the ordinance, which includes a web-based reporting portal through which relevant authorities submit their reporting (Kownacki, Englund, Krunegård, & Wallin, 2021). The analysis conducted by the SMHI sets out to produce insights on the following questions:

- How have the respective authorities carried out their assignment on climate adaptation?
- Which risks and opportunities have been identified and prioritized?
- Which adaptation needs have been identified that are currently being addressed?
- What obstacles and wider needs have been identified?

The SMHI has also established a methodological framework for the monitoring and evaluation of climate risks and adaptation for given authorities within its remit and responsibility and is currently developing a proposal for the government for a system to evaluate compliance, effectiveness, and follow-up.

Aside from the SMHI, several national institutional bodies play a critical role in monitoring and evaluating the implementations and effectiveness of climate adaptation measures. The **Expert Council** has been central in assessing the

effectiveness of government policies and adaptation measures across national and subnational levels. The **National Audit Office** has a statutory role in monitoring the compliance of the Swedish government and national agencies to legislations passed by parliament. In this context, the audit office has recently published a report evaluating the effectiveness of national authorities support to municipalities in implementing climate adaption in the built environment (Riksrevisionen, 2022). The National Audit Office concluded that Sweden lacks a national system for monitoring and evaluation which is needed to judge whether governmental or municipal actions contribute to lowering the risks of landslides, erosion and flooding in the municipalities.

6.2. Policy instruments

To date, climate adaptation policies and actions in Sweden have largely focused on developing capacity building and strengthening ownership and mandates across national agencies to support adaptations in their own respective sectors, as well as providing subnational authorities with the technical support to guide adaptation work on both regional and municipal level. Although the Swedish government has in recent years made efforts to provide a clearer direction on roles and mandates for adaptation, these have largely been confined to spatial planning. Therefore, serious disparity between mandates and legal obligations remains. Also, financial resources and institutional capacity are still insufficient to realize the required adoption of adaptation measures, against a backdrop of limited economic incentives.

Capacity building

An important milestone for climate adaptation in Sweden was the establishment of the **Swedish Expert Council on Climate Adaptation**, which is appointed by the government and consists of experts from a wide range of disciplines (e.g., climatology, spatial planning, health, and social science). The council is assigned with the task of mapping out the overall vulnerabilities of Swedish society to climate change and to provide guidance on how work on climate adaptation should be developed in Sweden (Nationella expertrådet för klimatanpassning, 2022b). The council is tasked with publishing a report every five years to provide advice to the government for its regular revision of the national climate adaptation strategy, including recommendations on adaptation priorities and cross-sectorial assessment of the societal impacts of climate change. The Expert Council also plays a pivotal role in following-up and evaluating past and ongoing work on climate adaptation.

The SMHI operates the **National Knowledge Centre for Climate Change Adaptation (NKCCCA)** established in 2012, which serves as an interdisciplinary knowledge hub

on climate adaptation and a platform for collaboration for different actors working in the space of adaptation, including public authorities, businesses, research institutions and civil society (Swedish Meteorological and Hydrological Institute, n.d.). The knowledge centre compiles relevant research and information and makes it understandable and accessible for people and organizations wanting to learn more about climate adaptation. The centre also regularly organizes knowledge-sharing initiatives and training courses, as well as operates the online portal on climate adaptation, **Klimatanpassning.se**, as a tool to further support the dissemination of information on climate adaptation in Sweden, with the view of supporting different societal actors to prepare for the consequences of climate change. The Swedish municipalities have also relied considerably on the knowledge centre to guide their work on climate adaptation, as the centre has developed a wide range of useful tools and guidelines to support adaptation on a local level (Interviews, Sweden).

Myndighetsnätverket för Klimatanpassning is a strategic cross-institutional network that brings together national agencies, the CABs and the **Swedish Association of Local and Regions (SKR)** twice a year to support knowledge-sharing and partnership-building around climate adaptation (Nationellt kunskapscentrum för klimatanpassning, 2022). Through this network, the national agencies and the CABs can establish partnerships (or consortiums) for climate adaptation projects and are eligible to receive funding for this work through the network. The entire network comes together twice a year in-person and hosts two virtual meetings for information dissemination, as well as organizing smaller working group meetings around specific themes (Interviews, Sweden).

On **subnational** level, many municipalities in Sweden have made considerable progress in strengthening the resilience of the local healthcare system in the anticipation of greater frequency and severity of heatwaves (Interviews, Sweden). In this context, the municipalities have been actively raising awareness of the health risks from heat-stress and developed guidelines to support adaptation to protect human health - especially among the elderly and other risk groups.

In context of the **private sector**, the agriculture and forestry industries have led progressive efforts to raise awareness among businesses in this sector of climate risks in the wake of recent forest fires and water shortages in agriculture, and stressing the importance of implementing adaptation solutions, (Interviews, Sweden). Management programs on climate adaptation have been organized within the forestry sector, and thus awareness of climate risks and adaptation solutions is quite high among Swedish businesses operating in weather-dependent value chains.

Incentive mechanisms

SMHI gets governmental funding to administer both the National Knowledge Centre for Climate Adaptation and the Swedish Expert Council on Climate Adaptation. Conversely, **national agencies** and **country administrative boards** that are subject to the government's ordinance on climate adaptation, are not automatically granted specific budgetary appropriations to support their climate adaptation work. However, the authorities can apply for funding of joint climate adaptation studies or actions through the climate adaptation network as mentioned earlier. In 2023, SMHI administer funding of around SEK 4 million across ten different projects. The CABs do get additional budgetary funds for their climate adaptation work and use this funding to both conduct climate adaptation work on a regional level and in some cases administer support to municipalities to aid the climate adaptation work on a more local level.

In addition, several national authorities administer funds that can be used for work related to climate adaptation, even if they were not designed as bespoke financial instruments for climate adaptations (Gram-Hanssen, et al., 2023). In absence of a dedicated fund for adaptation, **MSB** has been a valuable source of funding to support prevention of natural disasters, which has been used for implementing adaptation measures in relations to flooding and landslides, although its narrow scope excludes other areas (e.g., nature-based solutions). While the MSB funds have seen a significant increase in only the last few years, from 25 million SEK to about 500 million SEK today, lack of institutional capacity to match the increased funding has created administrative bottlenecks regarding the processing of applications, which has hampered the financing of adaptation projects (Interviews, Sweden). The Government has also dedicated a specific fund directed at projects to reduce the risks of landslides and erosion along the river Göta Älv. The fund is administered by the Swedish Geological Institute (SGI) and amounts to 115 million SEK in 2023.

The **NKCCCA** centre has provided a comprehensive list of various funding instruments that are available from different national agencies that could be used to finance projects that relate to climate adaptation. Some of these financial instruments are enumerated below in box 6.2 (National Knowledge Centre for Climate Change Adaptation, 2023).

Box 6.2. Examples of instruments for financing climate change adaptation

Swedish Environmental Protection Agency: The agency operates a funding programme (LONA) that provides partial funding to support various projects aimed at environmental conservation and protection, including the restoration of wetlands.

Swedish Agency for Marine and Water Management: The CBAs can apply for funding through the agency's LOVA grant scheme, to support municipalities and non-profit organisations in local efforts to improve marine and water environment.

Swedish National Board of Housing, Building and Planning (Boverket): Boverket provides funding for certain measures that enable energy efficiency and other environmental improvements (e.g., heating systems and waste management), in social and cultural venues that are not run by the government, such as museums, theatres, concert halls and art galleries.

Swedish Forest Agency: The agency runs the Nokås funding programme that provides finance to support measures to improve Swedish forestry by promoting biodiversity, restoration of wetlands, among other measures.

Swedish Transport Administration: The transport administration occasionally provided funding for municipalities to climate-proof existing urban infrastructure (Johansson, 2015).

Swedish Innovation Agency (VINNOVA): VINNOVA runs several challenge-driven funding programmes, including one on "Civil society solutions for a resilient society" which provides finance for cross-sectoral innovation partnerships and solutions for climate adaptation and social resilience.

Swedish Research Council for Sustainable Development (FORMAS): FORMAS has established a funding instrument to support collaborative platform, known as Policy Lab, for public and private sector actors to engage in policy exchange, development, and experimentations, in support of climate adaptation.

Swedish Agency for Economic and Regional Growth (Tilväxtverket): Tilväxtverket provides financial support to facilitate sustainable development in businesses, through so their so-called "Checks for a Green Transition" initiative. The financial support is accessible for companies to develop solutions to enhance biodiversity and ecosystem services and climate adaptation measures.

Aside from these financial instruments, the economic incentives to drive greater work on climate adaptation have been quite weak in Sweden. In fact, the **Expert Council** has stressed the need for greater, long-term, and more integrated financial instruments and other economic incentives to advance climate adaptation across Sweden (**Nationella expertrådet för klimatanpassning, 2022a**). In fact, the council called on the government to provide greater funding for municipalities to support local adaptation measures, as well as to put in place innovative financial mechanisms that allow municipalities to capitalize on linkages between adaptation, biodiversity, and nature-based solutions. According to the council, there is also a strong need for some type of co-funding mechanism, like public-private partnerships, that can create incentives for private property owners to implement adaptations. According to policy experts consulted, the insurance industry in Sweden is currently considering possibilities to implement some kind of premiums to incentivize adaptation measures, although companies have not yet taken any actions in this matter.

6.3. Best practices and main challenges

Despite calls for a national adaptation strategy for Sweden as early as in 2007, and especially in the wake of the catastrophic impacts of cyclone Gudrun the following year, subsequent governments dragged their legs on this issue and the country's first national adaptation strategy only saw the light of day, eleven years later in 2018. Even after its long-awaited publication, the strategy was widely perceived as being in many cases vague and not sufficiently detailed (Interviews, Sweden). In its 2022 report on the state of climate adaptation in Sweden, the Expert Council stressed that the forthcoming national adaptation strategy needs to be clearer and more concise to avoid the ambiguity; a frequent criticism levelled against the existing strategy. For example, the council called for a clearer signal on expectations, risk ownership and responsibilities for adaptation (including financing), in the new adaptation strategy (Nationella expertrådet för klimatanpassning, 2022a).

A greater **clarity on responsibilities and risk ownership** will be essential to address the disparity on the subnational level between statutory obligations of the CABs on climate adaptations on one hand, and the responsibilities and remits of the municipalities in the absence of such legal mandate. While the CABs have been legally assigned with the responsibilities to report on adaptation work that is carried out on a regional and municipal level, the municipalities do not have any legal requirements to report on their adaptation work to the CABs let alone implement adaptation measures beyond those measures that are covered by the amendments of the Planning and Building Act and the Land Act, or within other existing remits of municipalities (e.g. in context of rescue services and security). Although much of the legislative underpinning for adaptation is anchored on spatial

planning, the requirements for factoring climate hazards into decisions are confined to permits based on new building plans and thus do not apply to existing plans (Interviews, Sweden). Furthermore, despite the legal mandate of the CABs to ensure that adaptation measures are implemented on a municipal level in line with the national adaptation strategy, they do not have any control-mechanisms to ensure compliance or enforce actions on the part of the municipalities.

Greater **clarity on legal and financial obligations between public authorities and private sector actors** (e.g., businesses and property owners) is needed, since existing construction and land-use legislations are too vague with respect to the responsibilities for climate adaptation (Interviews, Sweden). This is particularly pertinent given the lack of legal and financial incentives and actions on climate adaptation, with respect to private property and infrastructure. Whereas the national adaptation strategy from 2018 stipulated that private property owners are themselves responsible for adaptation for their own assets, this has not been clearly communicated to the property owners and thus many assume that the municipalities are responsible for safeguarding private property within the limits of the municipalities (Interviews, Sweden). In fact, a strict interpretation of the Act on Local Government (Swedish Ministry of Finance, 2014) would mean that municipalities are not authorized to use tax-payers money for measures that would substantially benefit private property owners and increase the value of said property. As such, municipalities would not be able to fund and implement adaptation measures to address a particular climate hazard (e.g., cloud burst) even though these measures would benefit both the property owner and the wider municipality (e.g., by safeguarding critical services).

Another related concern relates to the fact that a given adaptation measure taken by the property owner may not necessarily contribute to wider municipal resilience, and in fact, could simply transfer or exacerbate the risk for the neighbouring property owners or the broader municipality. Against this backdrop, the Expert Council stressed that there is a strong need for innovative policy frameworks or other arrangements to strengthen public-private partnerships to bridge the current gap on risk ownership, such as by developing and enabling co-financing models and cooperative business models.

One of the main objectives of the new national climate adaptation strategy, that will be published in 2023, will be to ensure **greater integration of climate adaptation across different sectoral strategies**. For this reason, the Swedish government established a cross-governmental working group in preparation of the strategy, to ensure that the strategy incorporates both the recognized climate risks and adaptation needs across different sectors, and to enable a greater harmonization between climate adaptation policies and other relevant policy portfolios. In addition, the assignment of responsibilities for climate adaptation across different government departments within their own remits and mandates, is also aimed at

ensuring a “whole-of-government” approach and stronger cross-sectoral integration (Interviews, Sweden).

Yet, the policy framework and institutional arrangement as set out by the government’s ordinance around the assignment of risk-ownership and obligations on adaptation, can at times make an integrated approach to climate adaptation somewhat difficult on an operational level, since each national agency is responsible for these assignments within their own respective mandate and remits. As such, the cross-institutional network for climate adaptation which the national agencies and the Swedish Association of Local Authorities and Regions participate in, plays an important role in strengthening coordination on adaptation between institutions and sectors (Interviews, Sweden). On the municipal level, an integrated approach to climate adaptation is even more challenging in the absence of a legal mandate. Because of this, municipal work related to adaptation is often carried out by different departmental units in context of their own sectoral remits and in silos, without any proper coordination around climate adaptation, except on the regional level by the CABs.

To bolster Sweden’s resilience to the consequences of climate change, a significant **increase in financial investment** is needed to advance the conduct of climate risk analyses and provide the much-needed market pull (Interviews, Sweden). In terms of the former, greater resources are needed to enable more detailed climate risk assessments on a national level that account for different climate change scenarios, coupled with an economic analysis that is largely missing today, while also enabling municipalities greater access to locally developed scenario analyses and other relevant risk information. Dedicated financial instruments and stronger economic incentives are also needed to facilitate the implementation of adaptation solutions against the wide array of climate hazards facing Sweden, whereas innovative co-financing solutions between public and private sector actors can play an important role in addressing some of the problems mentioned above with respect to issues around shared liability (Interviews, Sweden).

The Expert Council argued that **transboundary consequences** of climate change could be at least as great for Sweden as the domestic climate risks, with implications for trade, food security, infrastructure, aid, international disaster preparedness and security policy (Nationella expertrådet för klimatanpassning, 2022a). This point has been echoed in consultations with government officials and policy advisors. For instance, a recent report from the Stockholm Environment Institute showed that Sweden is more vulnerable than previously thought to the cross-border impacts of climate change through its import reliance of food and agricultural products (Benzie & Lager, 2022).

Sweden has made some early strides on so-called **just transition**, which alludes to the importance of embedding justice and fairness considerations into adaptation decisions, similarly as it has been more commonly discussed in context of mitigation

(i.e., just transitions). In 2021, the government issued a decree on financial support for projects to enhance sustainability and resilience (e.g., via nature-based solutions) in socially and economically disadvantaged neighbourhoods (Swedish Ministry of Rural Affairs and Infrastructure, 2021). NKCCCA has also carried out an internal needs-assessment on just adaptation with focus on gender, which has resulted in several actionable proposals around awareness-raising, knowledge exchange, method development and collaborations. Following this work, NKCCCA is working with partners on developing a methodological framework to work on just adaptation in Sweden.

Taken together, the Swedish government has made important progress on developing some of the governance structures and policy frameworks needed to accelerate climate adaptation in Sweden, and the upcoming national adaptation strategy presents an opportunity to address some of the outstanding challenges to adaptation, regarding both horizontal and vertical integration, risk ownership, finance, and transboundary climate threats. However, as stressed by the Expert Council, the development of a national adaptation plan (NAP) is much needed to signpost action plans across national agencies and subnational authorities against overall national aims and objectives on adaptation.

7. Comparison and synthesis

As becomes clear from the country chapters above, all Nordic countries are experiencing the impacts of climate change and working to adapt to a changing climate in ways that enhance their resilience. While there are some similarities in terms of both the impacts experienced and the governance structures used to respond, the approaches to and experiences with adaptation also vary when it comes to planning, execution, and evaluation of climate change adaptation policies. The purpose of this chapter is to identify key progress factors for climate change adaptation and highlight best practices and main challenges to support learning and enhance adaptation across the Nordic region.

7.1. Key progress factors

Throughout the country chapters, certain aspects of climate change adaptation stand out as being particularly important for assessing and furthering national adaptation. These can be identified as key progress factors, and include:

- The existence and active use of national adaptation strategies and plans (NAS and NAP).
- The clear articulation of responsibility across public bodies, including identification of Ministry and/or cross-sectoral body with coordination responsibility and the political mandate to follow up non-compliance.
- The clear involvement and support of county- and/or local-level authorities.
- A clearly articulated policy cycle, including risk assessments and systems for monitoring, reporting and evaluation (MRE).
- The availability and active use of policy tools that incentivise climate change adaptation across societal actors, including economic measures.

Table 7.1 shows a comparison of the five Nordic countries across these progress factors. Best practices and main challenges are described in the sub-section below.

The notion of progress factors is also partially addressed in the final chapter of the report, where we look ahead to what the Nordic countries might aspire to in the years to come.

Table 7.1: Cross-country comparison according to key progress factors

Element	Denmark	Finland	Iceland	Norway	Sweden
Strategies and action plans guiding adaptation nationally	NAS (2008) and NAP (2012, update underway)	NAS (2005) and NAP (2014, 2023)	NAS (2021) (NAP process underway)	NAS (2008) and NAP (2013, 2023, expected)	NAS (2018, 2023, expected) and SAPs* (2015–2019)
Adaptation included within sector-specific laws and strategies	E.g., Planning Act; Service Level Act	E.g., Environmental Administration and Transport; Communication	No	E.g., Planning and Building Act	E.g., Building and Planning Act
Superior government body (ministry) with responsibility for adaptation	The Government	The Government	Ministry of Environment, Energy and Climate	Ministry of Climate and Environment	Ministry of Climate and Enterprise
Government body with operational and coordination responsibility	Environmental Protection Agency	Ministry of Agriculture and Forestry	Ministry of Environment, Energy and Climate	Environment Protection Agency (Directorate of Civil Defence up to 2013)	Ministry of Climate and Enterprise
Cross-sectoral working group or council	No	Inter-ministerial coordination group led by the Ministry of Agriculture and Forestry	No	Inter-directorate group led by Environment Protection Agency	Inter-ministerial working group led by the Ministry of Climate and Enterprise
Government-appointed expert council or panel	No (The Danish Climate Council focuses on mitigation)	The Finnish Climate Change Panel	The Icelandic Climate Council	No	The Swedish Expert Council on Climate Adaptation
Public body with main responsibility for adaptation at the sub-national level	Municipalities	None (county authorities and municipalities are involved)	None (municipalities responsible for mitigation)	Municipalities and county municipalities	Municipalities and county administrative boards
Systematic risk assessment	Regularly for certain sectors (e.g., coastal authorities)	Regularly, national	Ad hoc for certain sectors	Ad hoc for certain sectors	Regularly for certain sectors, e.g., forestry authorities)

MRE system	No (voluntary at the sub-national level)	Under establishment (annual report to Parliament by the government)	No (annual report to Parliament by Ministry of Environment, Energy and Climate)	No (annual report to Parliament by Ministry of Climate and Environment)	Partially (annual report to Parliament by SMHI; national evaluation by Expert Council every five years)
Assessments of adaptation on the national level	No	<u>2009</u> (NAS); <u>2013</u> (NAS); <u>2019</u> (NAP); <u>2022</u> (NAP)	No (planned)	<u>2022</u> (the built environment) <u>2022</u> (national agencies)	<u>2020</u> ; <u>2021</u> ; <u>2022</u> ; <u>2023</u> (annual evaluations of public authorities) <u>2022</u> (the built environment) <u>2022</u> (first evaluation of national climate change adaptation by Expert Council)
National assessments/surveys of adaptation on the sub-national level	<u>2017</u> ; <u>2017</u> (municipalities)	<u>2022</u> (regional centres and municipalities)	No	<u>2008-2019</u> (annual surveys of municipalities); <u>2008</u> ; <u>2018</u> ; <u>2019</u> ; <u>2021</u> (municipalities)	<u>2020</u> ; <u>2021</u> ; <u>2022</u> ; <u>2023</u> (annual evaluations of public authorities)
Availability of economic incentives **	Low (some funding and insurance schemes)	Very low (some insurance schemes)	Very low (some funding schemes)	Low (some funding and insurance schemes)	Low (some funding and insurance schemes)

* While there is no National Adaptation Plan (NAP) in Sweden, there are numerous sector-specific plans (SAP).

** The general lack of economic incentives in the Nordic countries makes it challenging to speak to progress within this area. The theme of economic measures and incentives is discussed in more detail below.

7.2. Synthesis of best practices and main challenges

Across the five country chapters of this report, a wide range of best practices and main challenges emerge, some of which are common for all countries and some of which are unique to individual countries. As described in the introduction to this report, our identification and analysis of best practices and main challenges is in part based on how adaptation has been evaluated within each country as well as by our interviewees. For this chapter, we have prioritized those issues that are relevant for two or more of the Nordic countries. For issues that are unique to individual countries, please refer to the overview of best practices and main challenges at the end of the individual country chapters.

We have synthesized best practices and main challenges across three interrelated themes:

1. Policies, systems, and tools
2. Responsibility, coordination, and collaboration
3. Integration

Policies, systems, and tools

Policies, systems, and tools are the essential building blocks for climate change adaptation to move from theory to practice and to ensure that progress is made within the necessary societal sectors. Policies, systems, and tools are therefore often the main focus of adaptation work, also in the Nordic countries.

In all Nordic countries, adaptation is guided by a combination of national steering documents, such as national strategies, action plans, laws, and regulations of various sorts as well as sector-specific adaptation plans to varying degrees. This indicates a mainstreaming approach to adaptation. The strength of this approach is that adaptation is considered within most societal sectors. A weakness can be that adaptation is considered within these sectors to a varying degree and thus risks "getting lost" within the already existing priorities and mandates of individual sectors and authorities. This weakness is reinforced by the fact that the prerequisites for policy integration are only partially in place. The most noticeable thing lacking is a coordinating body with a sufficient political mandate to supervise and, if necessary, enforce policy actions in sectors that do not follow up on their adaptation responsibilities (see the section below on responsibility, coordination, and collaboration). This is a weakness of adaptation policymaking that applies to all the Nordic countries, with some minor differences.

The above challenge becomes a particularly pronounced risk in the absence of systematic and regular monitoring, reporting and evaluation (MRE). Currently, none of the Nordic countries have comprehensive MRE systems in place, yet Finland, Norway and Sweden have elements of such a system in place (e.g., formal annual

reporting procedures on adaptation progress to the respective Parliaments) and are working on establishing more comprehensive systems. The lack of systematic and regular MRE means that the Nordic countries to some extents are "in the dark" when it comes to assessing and prioritizing adaptation work. The challenge of developing MRE systems is particularly related to the lack of appropriate national indicators for the diverse and multidimensional effects of climate change adaptation measures, including especially qualitative parameters, such as wellbeing (a weakness that applies to all the Nordic countries). The lack of MRE systems is related to the lack of a clearly articulated policy cycle where the production of risk assessments, strategies, plans, and evaluation reports follow each other in a predictable and regular manner, to track adaptation progress and ensure the timely development and implementation of appropriate measures.

All Nordic countries have well-established scientific communities that can provide the scientific basis for risks, vulnerabilities and adaptation needs. Much of the existing knowledge is made readily available through diverse platforms and websites, providing a rich resource for both planning and implementation. Despite the existence of relevant knowledge institutions and platforms, however, most of the Nordic countries lack sufficient mechanisms for systematic knowledge generation on climate change-related risks and vulnerabilities, including the socio-economic costs and benefits of action and inaction, and the inclusion of relevant user groups in co-production of knowledge. Funding for climate change-related research is predominantly directed at mitigation, while research on adaptation receives a fraction of the funding. Similarly, natural science research tends to be prioritized over social science research. This results in a persistent "black box" of how authorities and individuals can respond to climate change in ways that are effective, sustainable and equitable. A related challenge pertains to the translation of climate change-related knowledge to county and municipal-level actors who need to develop and implement adaptation measures.

Economic measures are a theme of growing importance in the Nordic countries, although the development of such measures is at an early stage. Economic measures can be divided into three main categories: positive (e.g., subsidies), negative (e.g., taxes), and neutral (e.g., insurance schemes that apply to natural perils). In general, for the Nordic as for most other high-income and western countries, no 'negative' economic policy measures have been established that specifically focus on the consideration of adapting society to climate change. In this respect, adaptation differs radically from the mitigation part of climate policy, in that negative economic instruments in the form of taxes and fees have such a central place - at least in the discussion (if not the actual implementation) of effective climate change mitigation policy measures.

Similarly, economic policy tools, and in particular cost-benefit analysis, are used far less compared to the emissions part of climate policy (Handberg et al, 2020). In recent years, several initiatives have been taken to develop and test practical schemes to use cost-benefit analysis in climate change adaptation, both generic (European Environment Agency, 2023; Nationella expertrådet för klimatanpassning, 2023) and within specific sectors (e.g., Handberg et al, 2023). However, this has proven to be demanding because of adaptation's multidimensional character. In comparison, emissions policy is simpler as it generally operates with only one benefit dimension: reduction in emissions of greenhouse gases.

To the extent that current adaptation policies in the Nordic countries do include economic policy measures, this relates to the category of 'positive' incentives (admittedly judged to be highly inadequate in terms of adapting society to a future climate), and the neutral category covering insurance schemes related to natural perils. Regarding the latter, Nordic countries – with Norway in the forefront – emerge as a leading region internationally. To a certain extent, insurance schemes are limited to today's climate, which constitutes a clear weakness, but the strength is that comprehensive schemes have been established giving the policyholders good financial security for the various forms of climate-related damage that may occur. There have been discussions, for instance in Norway and Sweden, about differentiating insurance premiums based on risk profile, so that, for example, owners of buildings located in high-risk areas for floods or landslides must pay higher premiums. But so far, such proposals have not gained traction. Such a differentiation could conceivably strengthen the incentives for preventive measures but would, on the other hand, have undesirable negative social consequences, which is likely why such proposals have so far been rejected. What makes the Norwegian system stand out in this context is a mandatory scheme where everyone who takes out home insurance must also pay a separate premium for natural damage, which constitutes an important mechanism for financing the scheme for natural damage.

Responsibility, coordination, and collaboration

Responsibility, coordination, and collaboration are the necessary conditions under which the above building blocks of policies, systems and tools can be developed and fitted to build appropriate and resilient structures for adaptation work.

The Nordic countries differ somewhat on how responsibility for adaptation is divided. In Iceland, Norway, and Sweden a designated ministry has the overall responsibility for adaptation (ministry of climate and/or environment). In Denmark and Finland, adaptation is the responsibility of the government as a whole. At the operational level of governance, the allocation of adaptation responsibility varies across the Nordic countries between ministries, directorates, and agencies. For instance, while in Norway, significant responsibility is transferred to multiple directorates and agencies, in Finland, only the ministerial level has official

responsibility. Finland, Norway, and Sweden have established cross-sectoral groups at the national level with minor variations in terms of political mandate and organisational set-up, to help ensure coordination across ministries and agencies. These groups are perceived as helpful in enabling cross-sectoral coordination and collaboration.

Despite the importance of these leading government bodies and cross-sectoral working groups, in most Nordic countries they lack the political mandate to put adaptation high on their national political agendas within the relevant sectors. This pertains to the specific challenge of adapting society to the future as opposed to today's (or yesterday's) climate, a point that is made, for example, by the Norwegian National Audit Office. The lack of political mandate also makes it challenging for most Nordic countries to embrace their responsibility and be accountable to local-level actors involved in adaptation. It further disables public bodies and private actors from accepting risk ownership and ensure that all risks are accounted for in both the planning and implementation of adaptation measures.

The close dialogue and collaboration needed to ensure a coordinated effort on climate change adaptation is hampered by a "silo" structure among ministries and sectors within all Nordic countries. One particularly clear example of this is the division between adaptation and mitigation, which are areas with high mutual impact and dependencies, but that nonetheless are situated within different ministries and with highly different political mandates. The lack of coordination and strategic collaboration between the fields of adaptation and mitigation results in missed opportunities for creating synergies and enhances the risk of goal conflicts.

Apart from Iceland, municipalities play a central role in adaptation work in all Nordic countries and are supported nationally with both knowledge and financial resources. The country placing most emphasis on municipalities is Denmark, where the government's primary role is to establish the legal frameworks for adaptation. As already mentioned, however, many municipalities across the Nordic countries find both knowledge and financial resources to be lacking, making it challenging for them to adhere to their mandate and assume responsibility. In some cases, it is unclear where the line is drawn between municipalities and the state, especially when it comes to financing adaptation. In most Nordic countries, there is also a lack of clarity with regard to the responsibility of property owners to ensure appropriate adaptation of private property.

Integration

Integration is closely related to the above theme of coordination and collaboration but goes deeper to ensure alignment of multiple societal actors, considerations, and goals. Integration is a key element in enabling adaptation to support sustainable development in the Nordic countries and beyond. As described in the introduction to this report, we understand integration in three distinct ways: 1) as the integration of adaptation within the existing work of public authorities (i.e., mainstreaming), 2) as the degree of collaboration and coordination between public bodies on adaptation-related questions, and 3) as the degree of alignment between climate change adaptation work and other closely related policy areas, such as GHG-mitigation, energy transition, biodiversity protection, and the SDGs.

In all Nordic countries, there is growing awareness of the interlinkages between climate change and biodiversity loss and the need to consider these two areas within the context of the Sustainable Development Goals (SDGs). All five countries are considering Nature-based Solutions (NbS) as a way of enhancing synergies and reducing negative impacts between these areas, although most of this work is at an early stage. In most Nordic countries, municipalities have come the furthest in integrating adaptation into municipal planning, although a general lack of resources hampers this work. The commitment to NbS across the Nordic region is exemplified by the Declaration "Finalising the Global Biodiversity Deal – The Nordic Approach", approved by the Nordic Ministers for the Environment and Climate (Nordic Council of Ministers, 2022a) and the subsequent Nordic Ministerial Declaration on nature-based solutions (Nordic Council of Ministers, 2022b).

Taking an integrative approach to adaptation is further hampered by a lack of knowledge of the most significant interlinkages between, for example, adaptation and mitigation, or energy transitions and nature protection. It is also hampered by a lack of appropriate and effective mechanisms for enhancing synergies and navigating goal conflicts. Linked to this challenge is a lack of appropriate indicators for measuring and evaluating societal impact beyond reducing immediate risks. This includes both long-term risks and vulnerabilities as well as qualitative aspects, such as wellbeing.

Finally, in some Nordic countries, the prioritization of economic growth and the weighting of quantitative criteria undermines the ability of adaptation efforts to sufficiently consider and integrate social and ecological concerns for the benefit of people and planet in a long-term perspective.

In Table 7.2 below, we have summarized the main findings of the report with respect to best practices and key challenges along the three interrelated themes.

Table 7.2: Summary of best practices and key challenges for adaptation in the Nordic countries

Policies, systems, and tools	
Best practices	• All Nordic countries have official steering documents (laws, White Papers, strategies etc.) that guide the work on adaptation and provide a common reference point for collaboration and strategic action. • All Nordic countries have well-established scientific communities that can provide the scientific basis for risks, vulnerabilities and adaptation needs. • All Nordic countries have well-developed platforms and websites for easy access to adaptation-related information.
Main challenges	• A majority of the Nordic countries lack mechanisms for systematic knowledge generation on climate change related risks and vulnerabilities, including the socio-economic costs and benefits of action and inaction. • Most Nordic countries lack systems for monitoring, reporting and evaluation (MRE) and all lack appropriate indicators for how to measure progress and results. • Most Nordic countries lack a clearly articulated policy cycle where planning documents, knowledge generation, and MRE procedures are situated in relation to one another and support the continuous development of adaptation work nationally and sub-nationally. • All Nordic countries lack appropriate indicators and measures to account for compounding, cascading and cross-border risks. • All Nordic countries lack sufficient economic measures to incentivise adaptation, resulting in a growing gap between adaptation needs and available finances. • All Nordic countries lack adaptation funding that meets the actual adaptation needs. • Most of the Nordic countries struggle with translating knowledge on risks and vulnerabilities to local adaptation measures.
Responsibility, coordination, and collaboration	
Best practices	• Some Nordic countries have an official government body (e.g., ministry, council etc.) with the official responsibility for coordinating climate change adaptation at the national level. • Some Nordic countries have cross-ministerial working groups that focus on cooperation and collaboration on issues pertaining to adaptation. • Most Nordic countries have a clearly articulated role for municipalities in developing and adopting adaptation measures at the local level. • In most Nordic countries, municipalities are highly proactive in identifying needs for and developing measures to adapt to climate change.

Main challenges

- Most Nordic countries **lack a political mandate** within the leading government body and the cross-sectoral working groups to put adaptation on the domestic political agenda. The lack of a political mandate further challenges their ability to **assume responsibility** and be held accountable to local-level actors, as well as **accept risk ownership** and ensure that all risks are accounted for in both planning and execution.
- In all Nordic countries, public administration is marked by a **"silo" structure**, which prevents effective cooperation and synergies across sectors and authorities.
- In most Nordic countries, a lack of **coordination and collaboration between adaptation and mitigation** leads to missed opportunities for synergies and enhancing the risk of goal conflicts.
- In most Nordic countries, there is a lack of clarity concerning the **responsibility of property owners** to ensure appropriate adaptation of their property.

Integration

Best practices

- All Nordic countries take a **mainstreaming approach** to adaptation, which means that all public authorities engage with adaptation to some degree.
- The interviewees in all Nordic countries are **aware** of the benefits of taking an integrative approach and seek to create synergies between their work and that of others.
- In some Nordic countries, adaptation at the municipal and county level is approached **in relation** to mitigation through integrated plans.
- In all the Nordic countries, approaches such as **Nature-based Solutions** (NbS) are becoming more prominent (at least in theory), enabling adaptation to be integrated with other related societal challenges.

Main challenges

- In all Nordic countries, there are concerns that a mainstreaming approach can lead to a situation where **no one is responsible** and adaptation is lost within the existing work of public authorities.
 - All Nordic countries **lack knowledge** about how to take an integrative approach to adaptation, e.g., how to align adaptation with goals for mitigation and the SDGs in a way that benefits from synergies and mitigates conflicts.
 - All Nordic countries lack **appropriate indicators** for measuring societal impact from adaptation measures beyond reducing immediate risks (e.g., wellbeing, empowerment, and dignity).
 - According to interviewees in some Nordic countries, the prioritization of **economic growth** and quantitative criteria undermines the potential of adaptation to consider and integrate social and ecological concerns for the benefit of people and planet in a long-term perspective.
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8. The future of adaptation in the Nordic region

The Nordic countries are at an important point in their adaptation journey, in which they have generated significant insight into climate change risks and the need for adaptation. As indicated in the previous chapter, much has already been done to enhance the adaptive capacity of the Nordic countries, and many challenges have been identified. As the countries progress further, more challenges and possibilities are likely to emerge.

To support this work, the final chapter of this report looks ahead at the potential that exists for adaptation across the Nordic countries to not only reduce risks and vulnerabilities but to support a sustainable and thriving Nordic region and beyond.

We have identified the overarching vision of **more transformational adaptation** as a frame for the potentials for adaptation in the Nordic region. The notion of more transformational adaptation is drawn from the increased recognition of the need to take an integrative approach to climate change, i.e., see it in connection with other societal challenges and priorities (O'Brien et al., 2022), and the framings within agenda setting documents from the Intergovernmental Panel on Climate Change (IPCC, 2022), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) and the EU (European Commission, 2019). Transformational adaptation is defined by the IPCC (2018, p. 542) as "adaptation that changes the fundamental attributes of a socio-ecological system in anticipation of climate change and its impacts". We perceive of transformational adaptation as an emergent goal that will likely rise on the Nordic adaptation agenda in the years to come.

To inform what more transformational adaptation might involve, we look to the aspirations of the 2021 EU adaptation strategy (European Commission, 2021). We take this strategy as our starting point due to the general lack of indicators for adaptation in the Nordic countries and the strategy's ability to work as a common framework across the countries through its status as an authoritative document, presenting a blueprint for successful adaptation aimed at "forging a climate-resilient union" (Ibid, p. 3). We draw out four goals from the strategy that we believe can be fruitful for estimating the potential for further enhancing adaptation in the Nordic countries:

- Smarter adaptation
- More systemic adaptation
- Faster adaptation
- More internationally oriented adaptation

Below we describe the framing and the four goals in turn, before suggesting how the Nordic countries might align their adaptation efforts with the goals.

8.1. More transformational adaptation

Within the academic literature, both adaptation and transformation are highly theorized fields, with transformative or transformational adaptation as a cross-cutting theme. Noting the nuances and debates within these fields, for the purpose of this report, we understand transformative adaptation to reflect a particular mindset that approaches adaptation as going beyond avoiding harm and taking advantage of benefits from a changing climate (Aall et al., 2015b). Instead, transformational adaptation uses adaptation as a mechanism for mobilizing societal resources for the enhancement of equitable, just and sustainable societies (Heikkinen et al., 2019; Pelling et al., 2015). Thus, rather than focusing only on the process and depth of change, transformational adaptation also aspires to a particular quality of change, guided by values of equity, justice and compassion for humans and nature (Aall et al., 2023; O'Brien et al., 2023).

It is challenging to work deliberately with transformational change, and research has found that most adaptation efforts that are framed as transformative, seldom are (Salomaa and Juhola, 2020). Thus, care is needed in identifying the linkages between adaptation and transformative change. According to the IPCC definition, *more transformational adaptation* should include describing and subsequently addressing the root causes of climate risks and vulnerabilities within strategies and plans. According to a growing consensus within the academic community, transformational adaptation should also include society-wide introspection on the values, visions and worldviews that can inform pathways for sustainable and equitable societies, as well as the development of strategies that connect long-term visioning with short- and medium-term actions and measures (e.g., Eriksen et al., 2015; O'Brien, 2012).

As with sustainability, the nature of more transformational adaptation in the Nordic countries will depend on the societal systems and structures already in place, and the people who inhabit them. Yet, the four goals from the EU strategy can act as helpful indicators for working towards more transformational adaptation (see Table 8.1 below).

Table 8.1: Four aspirational goals for climate change adaptation

Goal 1: Smarter adaptation – <i>knowledge-based decision-making</i>	Smarter adaptation emphasizes the need for anchoring decisions in the latest science and enhancing the understanding of the interdependencies between climate change, ecosystems, and their services. It also calls for more and better climate-related risk and impact data from both the private and the public sector that also accounts for uncertainties, recorded, and collected in a structured way and made accessible to all.
Goal 2: More systemic adaptation – <i>holistic and inclusive approaches</i>	More systemic adaptation calls for anchoring adaptation strategies and plans in latest science, developing systems for MRE and enhancing policy coherence. This can support adaptation through mainstreaming adaptation, avoiding maladaptation and malmitigation, and ensuring alignment between risk ownership and responsibility. It also focuses on how to enhance local resilience through supporting local and regional authorities in just and fair adaptation, including through financial measures and incentives. Among other things, this includes integrating climate risks into fiscal frameworks and conduct risk assessments based on climate scenarios and promoting and financing integrative measures, such as nature-based solutions.
Goal 3: Faster adaptation – <i>effective and accessible tools</i>	Faster adaptation focuses on enabling swift and effective responses through enhancing financing of adaptation and access to actionable solutions, including through support systems and technical advice. It aims to reduce climate-related risk by investing in climate-proof infrastructure and ensuring synergies between adaptation and disaster risk prevention and reduction. It also emphasizes the importance of closing the climate protection gap by using insurance as a risk transfer mechanism and innovate insurance regimes.
Goal 4: More internationally oriented adaptation – <i>responsibility and scaling</i>	More internationally oriented adaptation calls for adaptation efforts to match mitigation efforts in priority and scale. It suggests doing so through increased support for international climate resilience and preparedness to both avoid climate related conflict and account for transboundary climate risks. It suggests scaling up international finance to build climate resilience and strengthen global engagement and exchanges on adaptation. The logic of more internationally oriented adaptation is both informed by an increased sense of the complexity of the risk landscape when considering transboundary climate risks and the need to take a whole systems approach (e.g., in terms of economic systems and ecosystems), as well as the acute need to take responsibility for current and historic emissions, especially in highly industrialized countries.

8.2. The Nordic potential

Enhancing the transformative potential of adaptation

The Nordic countries are uniquely positioned to take a transformative approach to adaptation as they have historically been on the forefront of transformative social movements based on justice and equality. Now is the time to show foresight and courage in climate change adaptation.

In all Nordic countries, adaptation is framed as a response to climate change to avoid the risks and take advantage of the opportunities that result from a changing climate. Yet climate change science suggests that transformation is becoming inevitable: transformation will be either by design or by disaster. This points to the need for **reframing adaptation as transformation**. All Nordic countries have agreed to follow up the UN's Sustainable Development Goals (SDG) through their own national action plans, which includes SDG 13 on urgent climate action and, more specifically, target 13.1: "Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries". Reframing adaptation as transformative and sustainable adaptation can help to ensure that adaptation efforts align with and support equitable and just change within the Nordic countries and globally. This is not primarily a technical exercise of changing the language of strategies and plans. Rather, it requires a deep-rooted cognitive and cultural shift within the adaptation community and beyond, both nationally and locally. This shift includes aiming more at proactive than reactive measures and at addressing the drivers of vulnerability, including the 'new' transboundary climate risks. Such a shift will need to be supported in various ways, for instance through programmes and platforms that help identify the linkages between adaptation and sustainability and how to work in an integrative way within specific sectors and locations.

Adaptation as transformation also requires the **alignment of adaptation with other societal goals**. While the benefits of taking an integrative approach to adaptation are increasingly recognized, in all Nordic countries there is a lack of knowledge about how to do so. For example, there needs to be more clarity on how to align adaptation with climate change mitigation and the other SDGs in a way that creates synergies and avoids conflicts. The integration of adaptation within other societal goals requires cross-sectorial conversations and collaboration explicitly aimed at operationalizing integration and developing strategies for such work. It could involve the inclusion of "integration criteria" in reporting and funding applications, to enable integration to become the "new normal". Such "box-ticking" must be backed up by institutional capacity building to ensure that authorities have the skills and resources necessary within their sector.

Aligning adaptation with other societal goals invites a **conversation about societal priorities**. More transformational adaptation will likely involve critically questioning the current prioritization of economic growth as the overarching goal for societal development. It will be important for the Nordic countries to ensure that economic development does not undermine adaptive capacity, in the Nordic region and beyond, recognizing economic activity as interdependent with social and ecological wellbeing in a multi-generational perspective.

Closing the knowledge-action gap

The Nordic countries have some of the best conditions for generating state-of-the-art research on and for climate change adaptation. Yet thus far it has not led to sufficient and timely action.

Closing the knowledge-action gap requires establishing **mechanisms for systematic knowledge generation** on climate change-related risks and vulnerabilities, including the socio-economic costs and benefits of action and inaction, and the inclusion of relevant user groups in co-production of knowledge. Such knowledge-generation should include both natural and social science questions and perspectives and take into consideration the growing recognition of transboundary climate risks as well as the insight that climate risks rarely occur alone. The latter point being captured in the term multi-hazards and illustrated through how the unprovoked war by Russia in Ukraine and the corona pandemic interact with various forms of climate risk.

Mechanisms for systematic knowledge-generation should be coupled with the **development of appropriate indicators** for measuring risks, vulnerabilities, and adaptation efforts, as well as evaluating adaptation outcomes. This should include indicators and measures to account for compounding, cascading and transboundary risks, including that of assigning responsibilities among stakeholders and government levels for addressing these risks. Evaluation work must move beyond current indicators of describing climate hazards and immediate risks (e.g., flooding and avalanche risks). More emphasis should be placed on developing indicators or proxies for evaluating qualitative aspects of sustainability, such as wellbeing, empowerment, and dignity.

Developing holistic and integrated systems

In the Nordic countries, there is growing awareness of the benefits of and need for integrated approaches to social-ecological change. Yet lack of political mandate and persistent silo structures stand in the way for this awareness to lead to action.

To enable all-of-government and cross-sector collaboration and planning, the **silo-structure** within Nordic societies must be broken down. Most notably, the separation between adaptation and mitigation present in all Nordic countries prevent the ability for actors and projects to draw benefit from the synergies that

can be created between these fields. Breaking down silo-structures and thinking will require careful deliberation that takes into account differing institutional logics and cultures and is guided by an overarching goal of sustainable development. Breaking down silos means that institutional routines must be established that ensure that a specific coordination body must be assigned a political mandate that makes it possible to effectively check that the various sector bodies follow up on their responsibilities, and that measures can be taken to ensure that such responsibilities are followed up. Breaking down silos can also make room for more integrative approaches such as **Nature-based Solutions (NbS)**, which are fronted as a type of adaptation measure that considers the interlinkages between climate change, biodiversity, and social justice. By prioritizing such approaches (through the explicit inclusion in strategies, funding for research and funding for implementation locally), the Nordic countries stand to not only avoid and address costly goal conflicts but also benefit from the synergies that can be created between such related fields. This requires, however, an explicit commitment to understanding the nuances of such approaches and to critically examine assumptions and “short cuts” for supposed “win-win-win” solutions.

Creating a holistic and integrated system for adaptation will require a **clearly articulated adaptation policy cycle** where knowledge generation, and monitoring, reporting and evaluation (MRE) procedures are situated in relation to one another and support the continuous development of adaptation work nationally and sub-nationally. Embedded in this task is the establishment of **national indicator systems** for climate change adaptation, going beyond existing indicators that describe how the climate itself is changing. Such a system must include indicators that describe the development of vulnerability, exposure, climate risk, and the implementation of measures for climate change adaptation as well as the impact of the measures. The system should also seek to describe the more demanding conditions that apply to the societal drivers that inhibit and promote effective climate adaptation.

Enabling adaptation in practice

The Nordic countries have highly sophisticated communications networks, which support the development and accessibility of knowledge and tools. Yet, thus far, there has been little to no development and use of policy tools that directly incentivise adaptation at the local level and in the private sector, including economic tools.

The development of **financial incentives** needs to happen at various levels and take a variety of forms. Incentives must account for both the national and local level actors, especially those responsible for protecting, maintaining, and upgrading physical infrastructure. There is a clear need to increase the use of “positive” economic policy measures, such as financing, and the Nordic countries are applying these to some extent. However, there is an equally clear need to assess how and to

what extent “negative” measures such as taxes and fees can be used for adaptation in the same way that such measures are used within the emissions part of climate policy. The same applies to developing and applying approximations of the cost-benefit method that can work within adaptation. For individuals, insurance schemes can be enhanced to incentivise proactive measures. The recently adopted law in Norway, which requires insurance companies to make publicly available data on payments for natural perils, can be a source of inspiration to develop a common Nordic model for natural perils insurance that better facilitates prevention against future natural perils caused by climate change. In addition, there is a need for innovative financial mechanisms that allow municipalities and private actors to capitalize on linkages between adaptation, biodiversity and the SDGs, e.g., through nature-based solutions. There is also a significant potential in co-funding mechanisms, like public-private partnerships, that can create incentives for private property owners to implement adaptations.

Another important step to supporting adaptation in practice is the **translation of climate change adaptation-related knowledge to local contexts**. More specifically, there is a need for “scaling down” climate predictions, to translate this into climate risks by assessing expected climate changes and expected societal changes (‘climate vulnerabilities’), and to link information about this with information about options for climate change adaptation measures to fit local contexts, which in turn requires assigning more resources to local and country-level authorities for both planning and implementation. Knowledge translation could be done through expanding the role of existing knowledge-generating bodies and platforms to include a wider set of climate risks (not merely the local physical climate risks), and to bridge the gap between climate and other types of risk that can contribute to intensifying the negative effects of climate change and should therefore be seen in context.

The Nordic region as centre for ethical and responsible adaptation

The Nordic countries have an international outlook and understand the need for collaboration and commitment beyond national borders. Yet, when it comes to adaptation, the outlook is largely national, undermining both cross-border learning and ethical commitments.

To support global climate action, the national Nordic governments should **give sufficient political mandate** to the leading bodies (e.g., ministry, agency, inter-sectoral group), to ensure that they can put adaptation high on their national political agendas within all relevant sectors as well as to be a leader internationally. Increased political mandate can enable the Nordic countries to embrace their responsibility and be accountable to local-level actors involved in adaptation nationally as well as international actors. It can further enable public bodies to accept risk ownership and ensure that all risks are accounted for in both the

planning and implementation of adaptation measures. Finally, enhanced political mandate will increase the likelihood of developing cross-Nordic strategies and collaborations in areas such as transboundary climate risks.

For the Nordic region to continue to be a trustworthy and visionary leader for social justice and equality, governments must **strengthen international commitments** for adaptation in an international context, which includes speaking up on behalf of nations and groups with less political and economic power, and follow up with courageous action, including but not limited to the commitments from UNFCCC COP27 on loss and damage. No country in the world is safe from climate change impacts until all countries are safe from climate change impacts. Therefore, Nordic governments and the Nordic region must take responsibility for climate change risks and impacts manifesting in other countries (many of which are in the Global South) that both directly and indirectly result from Nordic economic patterns of production and consumption.

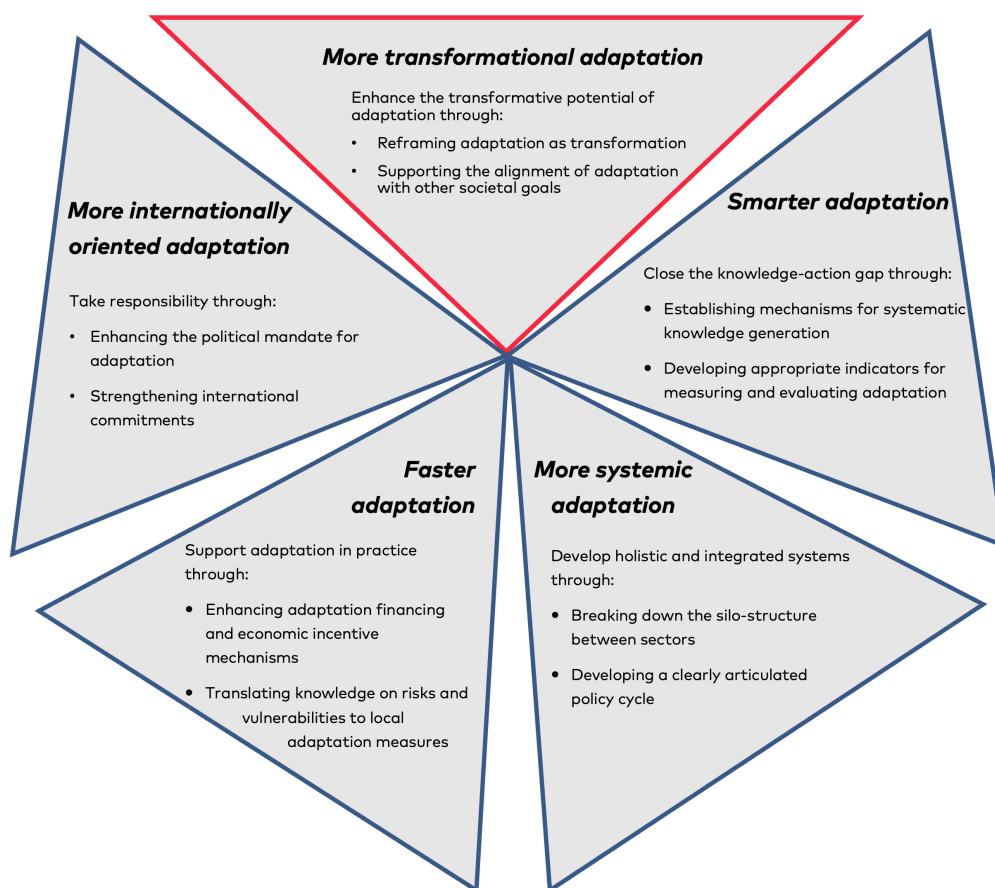


Figure 8.1. Visual summary of policy recommendations

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