Transformative innovation for better Climate Change Adaptation – Case study: Espoo, Finland

Authors: Dienhart, C., Korneeva, E.
Editor: Gnamus, A.

2024





EU Science Hub
https://joint-research-centre.ec.europa.eu

JRC137316

PDF ISBN 978-92-68-13902-8 doi:10.2760/177322 KJ-02-24-396-EN-N

Luxembourg: Publications Office of the European Union, 2024

How to cite this report: European Commission, Joint Research Centre, Dienhart, C. and Korneeva, E., *Transformative Innovation for better Climate Change Adaptation - Case Study: Espoo, Finland*, Gnamus, A. editor(s), Publications Office of the European Union, Luxembourg, 2024, https://data.europa.eu/doi/10.2760/177322, JRC137316.

Contents

Abstract

The aim of this report is to investigate the potential for harnessing key features of Transformative Innovation to improve the design and the implementation of Climate Change Adaptation (CCA) strategies, based on empirical analyses. The study draws on the conceptual framework on this question previously defined for the JRC (European Commission, 2024), and the methodology for case studies articulated in the same report. The case study research comprises overall 14 case study reports covering 16 territories from across the EU and beyond, casing various institutional contexts, a variety of biogeographical regions within different climate risks, different ranges of population sizes, and representing a diversity of approaches to CCA and transformative innovation[1].

The framework takes the form of an analytical grid, structured into seven sections, each of them representing a key feature of the 'transformative innovation' approach where the features are understood as essential conditions for the design and implementation of CCA strategies with this high level of ambition. Each section sets out the main question(s) to be addressed in relation to its respective transformative innovation feature.

This Report provides the findings for Espoo region in Finland, as at October 2023 and is the result of a collaboration between the Joint Research Centre (JRC), DG CLIMA and DG RTD.

[1] A full list of the case studies is provided in Annex 2

Acknowledgements

The authors would like to thank those persons who participated in the interviews (list in Annex 1) and shared their expertise to write this case study report, as well as staff of the European Commission in charge of this project, both from JRC (Karel Haegeman, Gérard Carat and Ales Gnamus) and from DG CLIMA (Irene Bonvissuto) and DG RTD (Prisca Haemers).

Executive summary

Policy context

Adapting to climate change has become an increasingly urgent priority for the EU and its territories. Given this urgency, and the systemic nature of climate resilience, new transformative ways to accelerate adaptation are considered. Transformative Innovation (TI) is the focus of this report, particularly how it can help supporting and accelerating adaptation to climate change. The analysis in this report draws lessons for the city of Espoo, Finland on how this approach may help the territory increasing climate resilience, and what can be done in addition, to further accelerate the Climate Change Adaptation (CCA). The analysis is based on a theoretical framework along seven dimensions designed previously for the JRC (European Commission, 2024), to compare TI and CCA. It is one out of a series of 14 case studies comprising various biogeographical regions with a variety of climate risks, various institutional contexts, different ranges of population sizes, and demonstrating a diversity of approaches to transformative innovation and CCA.

Main findings

The city of Espoo and its region Uusimaa form, together with the cities of Helsinki, Vantaa, and Kauniainen, the Helsinki Capital Region or Helsinki Metropolitan Area. The region has been notoriously active in the climate protection related endeavours and have through time formed a very competent public bodies' network and effective inter-territorial climate oriented collaboration at various levels. Espoo has clearly recognized its climate threats and risks and categorized them into three categories:

(1) Floods, heavy rain and storms,

(2) Heat waves, drought, and forest fires,

(3) Decline of natural biodiversity, which further reduces the territory resilience to climate changes.

Most of the adaptation activities however are focused at the key climate risk for the territory, which is the storm water management.

Goals and Directionality: Espoo considers a system change where it aims to consider alternatives to the main climate pressures with the storm water discharges via the sewage system by using green spaces, open and boundary ditches and other alternatives.

Articulating Policy Portfolios: Espoo is using domestic and to some extent European funding to finance CCA projects. A lot of effort is put into creating conditions for making future developments climate resilient. The city supports its goals with regulation instruments. Substantial efforts are also being made on building localised data and observatories, warning systems, tools to monitor and understand climate threats.

Ensuring Cross-Domain Synergies: Espoo favours whole-of-government approaches by breaking silos. Several departments work together on strategic CCA goals, ensuring important topics are integrated into various projects and act in synergy.

Increasing Breadth and Depth of Stakeholder Involvement: Stakeholders involvement is in place to assure resilient management of climate change threats and citizens are informed about the importance and obligation of their contribution. Similarly, the relevant organisations are working in close cooperation to protect vulnerable groups from negative effects caused by climate change in the city and the region.

Setting up Effective Multi-level Governance Models: The city of Espoo is planning and executing its CCA strategy in line with the regional, national, and European strategic and legal frameworks. In practice CCA actions are implemented by local authorities, which propose projects directly to the national, and European governance level. Through the Helsinki Region Environmental Services Municipal Corporation (HSY) there is a strong cross-municipality cooperation between Espoo, Helsinki, Vantaa, and Kauniainen on CCA.

Making Room for Experimentation: There is limited experimentation on innovative CCA solutions in Espoo, with exception of one single project, which managed to conduct a wide range of experiments to test the effects of blue-green infrastructures on the health of participants.

Securing High Levels of Policy Intelligence, Learning, and Strategic Capacity: The development of a strong knowledge base and the strategic documents (SECAP; Action Plan for CCA in Espoo 2022–2025; Espoo Climate Watch) signals strong strategic capacities. The climate adaptation projects also have a strategic character. The majority of projects focus on further developing the knowledge base, monitoring, informing, planning, promoting and analysing. However, interdisciplinary research is not in the focus of CCA actions in Espoo, therefore to enhance the transformative innovation approach, more interdisciplinary research is needed in the territory.

Key conclusions

To address the identified issues and a successful integration of transformative innovation for climate change adaptation at the local and regional levels, the following observations can be made regarding the seven transformative innovation features for the Espoo area that may be summarised as follows:

Goals and Directionality: Eight adaptation measures have been defined and introduced through the broad stakeholder engagement to respond to the main CCA needs. They comprise the use of green and blue infrastructures, adaptation of social and health services to the changing climate and extreme weather phenomena, climate-smart living, storm water management, preparing water supply for heavy rainfalls, preparing for climate risks, regional cooperation in planning the transport system, and cooperation with companies and organizations. In most of them, they have embedded characteristics of transformative innovation, which allows for effective CCA strategies that are progressively phasing out unsustainable models and replacing them by more resilient ones.

Articulating Policy Portfolios: Despite reasonably well articulated local, regional, national and European support, the city is advised to expand the policy portfolio for CCA through the European funds for innovation (e.g., ERDF, Horizon) and through the Smart Specialization Strategy activities.

Ensuring Cross-Domain Synergies: Despite building on relatively solid synergies relevant to CCA, the territory should foster inter-disciplinary research and integrate its results into CCA projects to contribute further to cross-domain synergies. Also, Espoo should exploit the potential of 'climate adaptation economy' to bring into the portfolio business-oriented innovation instruments and further investigate if there are any silos at the strategic level.

Increasing Breadth and Depth of Stakeholder Involvement: Despite relatively developed stakeholder involvement, certain additional measures could be put in place to further improve the climate resilience of the territory. These include establishing mechanisms (incentives, procurement) to ensure strong business involvement and foster a 'climate adaptation economy'; include citizens at the strategic level, e.g., through workshops where different resilience levels are discussed under different goals that are set; set up challenges for citizens to find CCA solutions in their districts to mobilize local environmental knowledge and understand socio-cultural factors; and transfer good practices built up under Espoo's innovation ecosystem for climate mitigation towards CCA.

Setting up Effective Multi-level Governance Models: Further to the already effective multi-level governance model in the area, recognizing the limited range of responsibilities and corresponding powers of local authorities as a barrier for transformative CCA strategies would be beneficial and a support and empowering of the local authorities to overcome these barriers will certainly help further improving the multi-governance model. Also, trade-offs between the institutionalisation of multi-level governance systems and their flexibility in the context of 'system change' implicit in transformative innovation approaches should be considered.

Making Room for Experimentation: Possible ways forward to overcome limited room for experimentation in the CCA are to integrate Espoo's innovation culture also in the CCA projects; to invite companies to test their solutions for CCA on buildings and properties and signal tolerance to failures in this endeavour, and finally reinforce regulatory sandbox initiatives relevant to the innovative CCA.

Securing High Levels of Policy Intelligence, Learning, and Strategic Capacity: To secure policy intelligence and strategic capacity for CCA activities in the city, the interdisciplinary research to build up transition skills should be fostered. Social and behavioural sciences would need to complement knowledge produced by climate scientists and the solutions developed by engineers. Furthermore, the local authorities should get a support in putting their strategic plans into action and providing information on funding opportunities for implementing bold, innovative projects. Also, the local authorities' abilities for long-term planning under uncertainty should be supported as it is a key enabler for transformative innovation.

1 Introduction

This report has been prepared at the request of the European Commission's Joint Research Centre (JRC), Innovation Policies and Economic Impact Unit, in collaboration with DG CLIMA. The aim of this report is to investigate the potential for harnessing key features of Transformative Innovation to improve the design and the implementation of Climate Change Adaptation (CCA) strategies, based on empirical analyses of territorial cases across Europe. The study draws on the conceptual framework on this question previously defined in another JRC report (European Commission, 2024). The case study research covered several territories from across the EU and beyond, comprising various institutional contexts, a variety of climate risks within different biogeographical regions, different ranges of population sizes, and representing a diversity of approaches to CCA and transformative innovation[2]. The methodology for the case studies relies on the following main sources:

- Qualitative interviews carried out with key actors in the two main policy fields: R&I and climate/environment.
- Other policy fields chosen for their particular relevance for each territory: e.g. regional development, spatial planning, energy, water, agriculture, forestry, food, fisheries, health, etc.
- Interviewees included decision-makers, officials in implementing bodies, researchers, NGOs and experts active in the field.
- Documentary and website analyses on strategies, policies and projects. A first round was carried out prior to the interviews on publicly available material, followed by a second round, with documents (public or draft) obtained from interviewees.

This Report provides the findings for Espoo, Finland, as at October 2023.

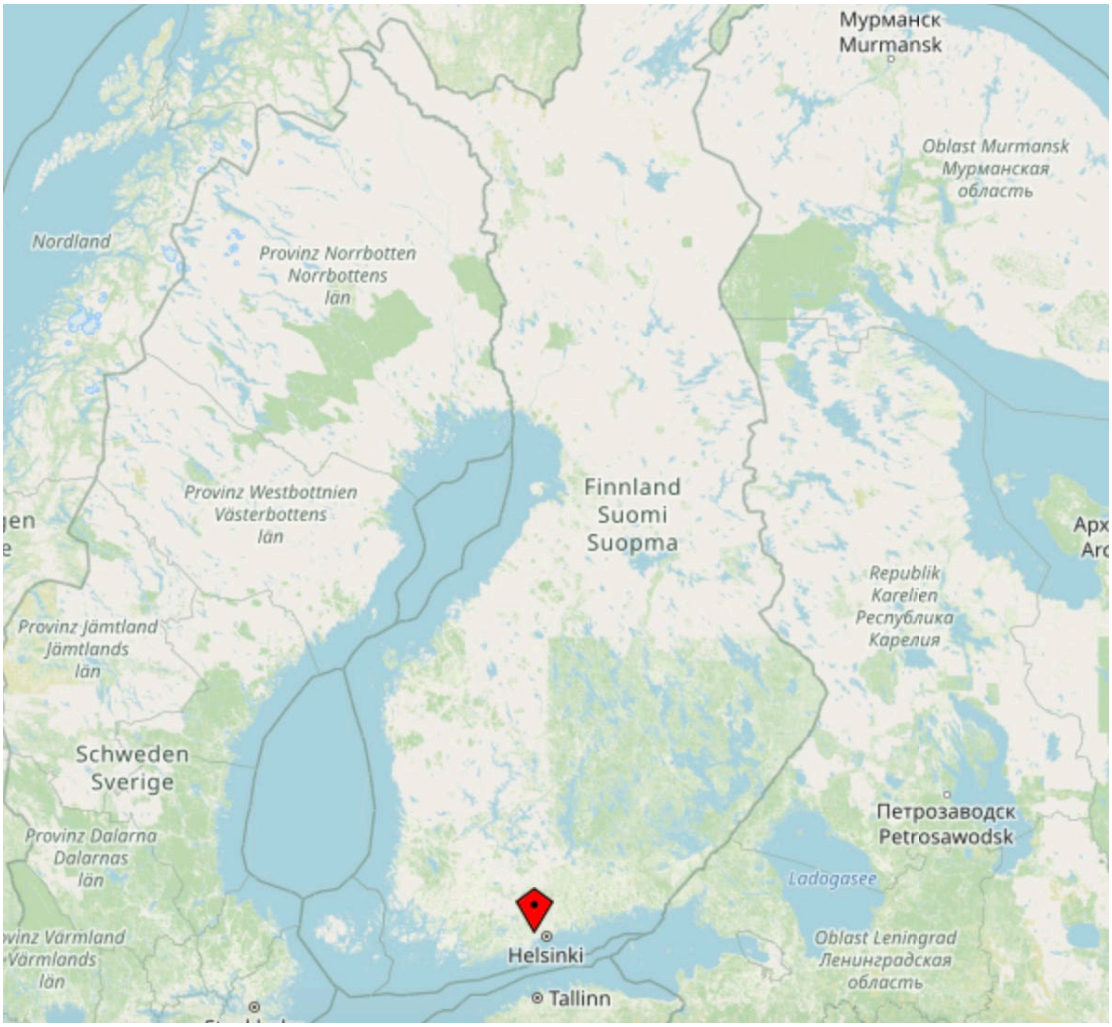
[2] A full list of the case studies is provided in Annex 2

2 Presentation of the case study territory

2.1 Profile of the territory

Espoo is a city and municipality in the region of Uusimaa in Finland. The city of Espoo covers an area of 312,22 square kilometres with a population of 310.912 inhabitants, making it the second biggest city in Finland. Espoo is part of the Helsinki Metropolitan Area, where more than 1,5 million people reside. Within the Helsinki Metropolitan Area (also referred to as Greater Helsinki), the four cities Helsinki, Espoo, Vantaa, and Kauniainen form the Capital Region. Espoo is situated in the South of Finland on the northern shore of the Gulf of Finland (see Figure 1).

Figure 1: Geographical location of Espoo in Finland.

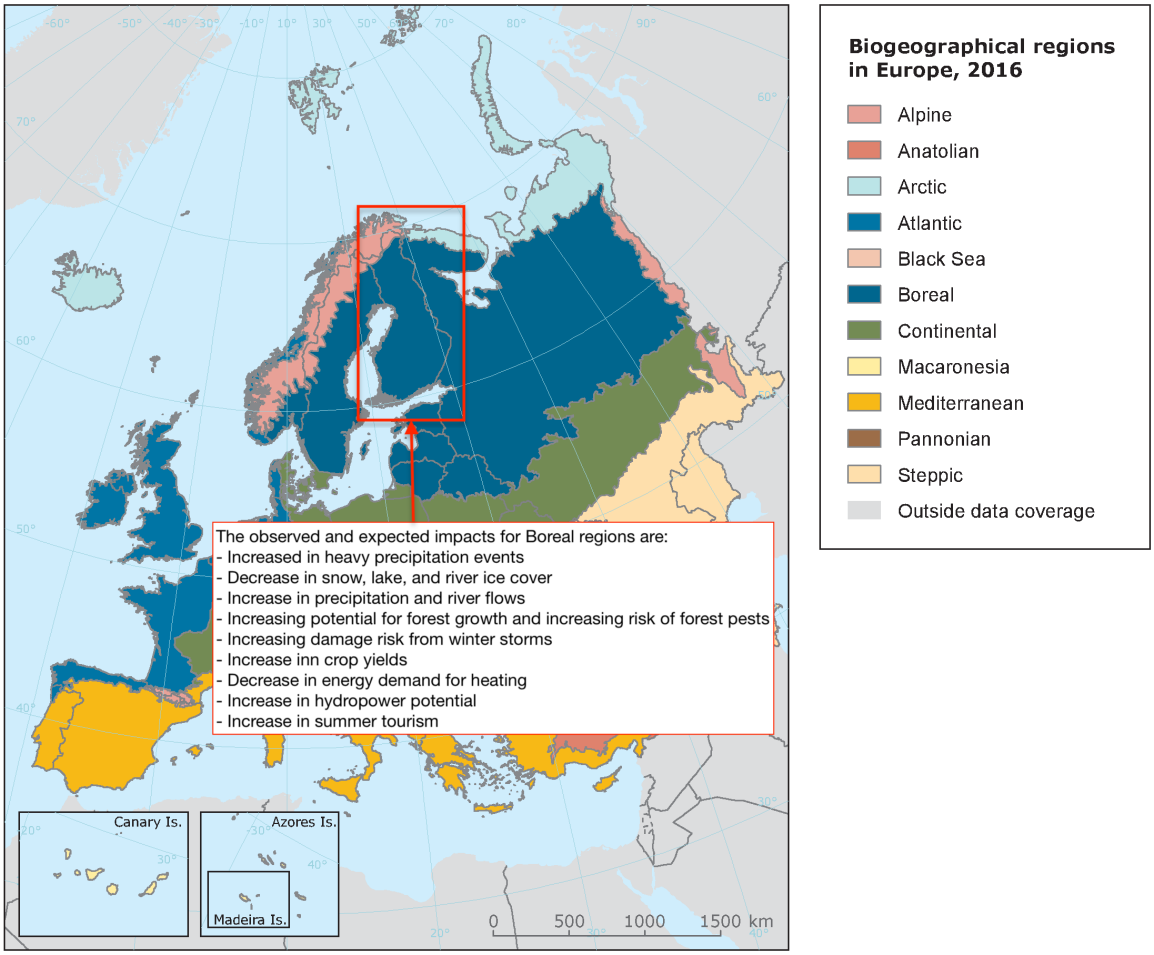


Source: Open Street Map, 2023

2.2 Main climate change risks and vulnerabilities

The European Environmental Agency has classified key climate impacts into biogeographical regions. The territory of Finland lies in the 'Boreal' biogeographical region (EEA, 2017). Figure 2 shows the biogeographical regions and the observed and expected impacts of climate change for the 'Boreal' region.

Figure 2: Biogeographical regions and impacts of climate change for the 'Boreal' region.



Source: Modified from EEA, 2017

Based on existing national, regional and local materials and the map of the Climate-ADAPT website of the European Commission and the European Environment Agency, the most relevant risks for the city of Espoo were identified. Maps from the Climate-ADAPT website were used, for example, in the assessment of storm water floods and extreme heat (SECAP, 2019). In addition, the statistics of the Rescue Department of Western Uusimaa on rescue tasks were used in the risk mapping. Based on the risk analysis the following risks of climate change have been identified:

- Extreme heat
- Extreme cold
- Heavy rains
- Floods from sea level rise and storm water
- Extreme drought
- Storms and
- Forest fires.

Based on experts' assessments, the three risks with the highest level of risk for the city of Espoo are floods, heavy rains, and extreme heat.

Espoo has identified the following major threats of climate change for the city using Indicator-Based Vulnerability Assessment (IBVA). In Espoo, floods from heavy rainfall, meltwater, and extreme heat pose a significant threat to the functionality of our society, the well-being of citizens, and the state of environment, buildings, infrastructure, and property. Furthermore, the impacts of climate change are progressively diminishing natural biodiversity, which, in turn, erodes the Earth's ability to adapt to the evolving climate. The survival and well-being of humanity are profoundly intertwined with the diversity of the natural world (Espoo Climate Watch – Climate Change Adaptation, 2023).

Espoo has categorized the threats of climate change into three categories:

(1) Floods, heavy rain, and storms: increased rainfall and floods and, by extension, risks to the continuity and safety of traffic, waste storage and water treatment processes.

(2) Heat waves, drought, and forest fires: increased extreme causes risks to the health and well-being of residents, drought, and forest fires.

(3) Decline of natural biodiversity: deterioration of biodiversity further reduces the ability to adapt to climate change.

2.3 State-of-play of CCA and innovation strategies

There are several strategic documents on climate change adaptation (CCA) that are relevant to the city of Espoo. The key strategic document for CCA is the Sustainable Energy and Climate Action Plan (SECAP) of the city of Espoo. As a signatory of the Covenant of Mayors Espoo prepared the SECAP and published it in 2019. The document includes a chapter on CCA. In this chapter, the city presents eight key priority areas for adaptation measures.

In Espoo, work related to adaptation to climate change is done in close cooperation with other municipalities in the capital region and HSY (Helsinki Region Environmental Services Authority). In 2012, a common CCA strategy was prepared for the capital region. The strategy included a number of adaptation measures that cities, municipal associations and other regional actors implement in their own operations. The goals of the adaptation strategy included assessing the consequences of climate change in the capital region, preparing for the effects of climate change and extreme weather phenomena, and reducing the region's vulnerability. The vision of the strategy is a climate-resistant city. A follow-up document was published in 2017, discussing new challenges. Furthermore, a national document for CCA was published in 2022. The following list shows an overview of the strategic documents.

- 2019: Sustainable Energy and Climate Action Plan of the city of Espoo (SECAP), City of Espoo.
- 2017: The New Challenges of Climate Change Adaptation in the Capital Region, Helsinki Region Environmental Services Municipal Corporation (HSY).
- 2012: Helsinki Metropolitan Area Climate Change Adaptation Strategy, Helsinki Region Environmental Services Municipal Corporation (HSY).
- 2022: Government Report on the National Climate Change Adaptation Plan until 2030.

Espoo's innovation ecosystem is considered a leading innovation hub in the Nordics (Espoo Innovation Ecosystem, 2023). As regards innovation strategy, Espoo implements a number of innovation initiatives with links to climate change but not specifically CCA (Innovation Initiatives, 2023). The initiatives focus on sustainable development, circular economy and climate change mitigation. For

example, Kiviruukki is an urban circular economy hub where solutions for a sustainable future are created together with partners and interested businesses. As a selected mission city for '100 climate-neutral and smart cities by 2030' Espoo committed to acting as a centre of experimentation and innovation for solutions that will enable all European cities to achieve carbon neutrality by 2050.

3 Analysis against conceptual framework: Transformative Innovation for better Climate Change Adaptation

In a separate analytical framework report for territories (European Commission, 2024), seven key features of Transformative Innovation have been identified as essential conditions for the design and implementation of CCA strategies. These features can be summarised as follows:

Directionality: defining goals and scope of strategic action, as well as articulating impacts, in a way which reflects societal challenges with wide appeal, formalised through endorsement at highest political level to secure engagement of all relevant authorities and stakeholders.

Articulating instrument portfolios and defining synergies between funding sources: establishing all-encompassing instrument portfolios addressing the whole innovation cycle and the various aspects of CCA, paired with adequate funding resources.

Ensuring cross domain synergies: favouring whole-of-government approaches to ensure greater horizontal coherence between various thematic policy areas (R&I, agriculture, environment, mobility, health etc.), resulting in coordinated mixes of instruments of different types.

Increasing breadth and depth of stakeholder involvement: working towards social acceptance of new solutions and shaping of innovative developments, as well as improving public trust, opening up public debates, managing diverse and sometimes conflicting views over alternative pathways.

Setting up effective multi-level governance models: maximising potential of vertical synergies, recognising complementary roles for various governance levels - local, regional, national and EU;

Making room for experimentation: providing adequate spaces for risk-taking and creativity - ensuring a risk-tolerant environment to facilitate development of new and/or radical solutions.

Securing high levels of policy intelligence, learning and strategic capacity: building strong evidence-based policy learning capacities, based on a solid knowledge base and special skills to manage transitions, as necessary companions to the transformative innovation approach.

The analysis below follows this framework. The key characteristics of the territory's approach to CCA strategy development and implementation and their linkages with innovation policies and strategies, as revealed by the case study research, are explored in turn, in relation to the above seven features. Each feature constitutes a core section of the report.

3.1 Directionality: defining goals and expected impacts for society

Formulating its goals, Espoo considers societal challenges (e.g., aging population and vulnerability of elderly people to weather extremes, such as heat waves). The focus on a just transformation helps to secure high-level political endorsement. In the storm water management, Espoo considers a system change (e.g., acknowledging that storm water does not need to be transported via the sewage system but considering alternatives such as green spaces, open and boundary ditches). Espoo acknowledges its importance towards business as it considers its potential to support businesses' adaptation efforts, for example by acting as a testing ground for new solutions.

What is missing are tangible goals and focus on innovative solutions towards climate resilience. Espoo has a strong database on climate and territorial data, which can be used to set and track tangible goals (e.g., green surfaces, amount of storm water that can be absorbed by the city). Additionally, Espoo's innovation ecosystem is considered a leading innovation hub in the Nordics. The city could use its innovation ecosystem to work on solution for CCA.

3.1.1 Goal definition

The city of Espoo has signed the EU Mission 'Adaptation to Climate Change'. As part of this mission the EU supports (a) regions and local authorities towards climate resilience by 2030, (b) building a community of practice on adaptation to climate change, and (c) delivering the European Green Deal and the Climate Adaptation Strategy.

As a signatory of the Covenant of Mayors for Climate and Energy (Espoo's Climate Goals, 2023), Espoo published a Sustainable Energy & Climate Action Plan (SECAP) in 2019.

3.1.2 Strategic governance

In preparation of the SECAP, a workshop with experts from the city's various industries and other stakeholders was organized to identify risks, evaluate them and derive adaptation measures. As a result, Espoo defines eight adaptation measures for CCA in the SECAP, which are described below.

(1) Green and blue infrastructure

Green and blue infrastructures, such as green areas, parks, green roofs and water bodies, contribute to CCA in several different ways. Green and blue structures promote the adaptation of the urban environment to floods and heavy rains, for example by delaying and retaining storm water. Green infrastructures reduce the vulnerability of residents and the environment to climate change by cooling buildings and creating shade.

The preservation of green infrastructures, green areas, urban forests and integrated networks of water nature is also important in terms of the diversity of urban nature. In addition, green areas, parks and waterways offer ecosystem services to city dwellers when they function as recreation areas and thus enable outdoor recreation, sports and recreation opportunities for city dwellers.

(2) Adaptation of social and health services to the changing climate and extreme weather phenomena

The effects of climate change, which threaten people's health and well-being, often target the most vulnerable groups, who often also have the weakest capabilities and the fewest resources to adapt to them. The most vulnerable groups include, for example, the elderly, poor, and marginalized people, the sick and disabled, and small children. In addition, people living in areas particularly exposed to

the effects may be in a more vulnerable position than others. The effects of climate change, such as heat, directly affect people's physical and mental health.

Espoo aims to prepare their health services (e.g., training, awareness, weather monitoring) and provide cool, public recreational spaces for vulnerable groups (e.g., outdoor recreation and green structures are combined in planning and construction, ensuring that apartments have a sufficient level of equipment).

(3) Climate-smart living

Zoning can ensure sufficient green areas, vegetation, water-permeable surfaces, storm water management and other measures implemented during the construction phase that promote adaptation to climate change. Zoning is a key tool when developing the adaptability of residential areas to climate change.

However, adaptation to climate change in terms of housing also applies to residents, who are responsible for the maintenance of buildings, apartments, and yard areas. In connection with repairs, it is possible to increase the climate resistance of old buildings and yard areas. Raising awareness among both residents and professionals is important in terms of adaptation.

(4) Storm water management

In the future, heavy rains and floods are estimated to increase. The sea water level is also estimated to rise in the coastal area of the capital region, which contributes to increasing the risk of storm water floods and making it difficult to drain storm water. Growing and densifying urban areas and the increase in the number of impervious areas contribute to the challenges of storm water management.

Storm water management and organic methods are part of Espoo's adaptation. The city has drawn up storm water program, and a storm water working group has been established to monitor the implementation of the program and guide the activities in accordance with it.

(5) Preparing water supply for heavy rainfall

Preparing the water supply system for exceptional weather events, such as very rare heavy rainfall events, has been studied by HSY. The aim of this work is to be able to prevent damage, estimate its magnitude and cost and identify effective adaptation measures.

(6) Preparing for climate risks

The city of Espoo is committed to continuously analyzing occurring risks, their impact and the damage so that risk management can be improved in the future. On this basis, adaptation measures can be designed, and different options can be assessed and compared. Risk mapping and the assessment of adaptation measures need to be carried out in cities on an ongoing basis as risks and their impacts change.

(7) Regional cooperation in planning the transport system

Climate change and weather variability will have an impact on the public transport system, so adaptation to climate change must be taken into account at the planning stage of public transport. HSY, in cooperation with other municipalities in the capital region, is developing the regional public transport system in particular. In addition, the city is actively working to develop other aspects of the transport system to adapt to climate change, such as walking, cycling and private cars.

(8) Cooperation with companies and organizations

Climate change will also affect businesses and their operations. Depending on the company and the sector, climate change may change the way companies operate, but it may also offer new opportunities for entirely new products and new businesses. It is important for businesses, and also for cities, to identify and understand the risks of climate change and to assess the implications for their operations. Cities have the potential to support businesses' adaptation efforts, for example by acting as a testing ground for new solutions. The contribution of organizations to CCA is valuable for cities. Some work already exists, but it could be extended and developed further.

Good practices for strategic directionality in the territory are summarized in Box 1.

Box 1: Good practices for strategic directionality in the territory

- Placing emphasis on social justice in goal definition in response to uneven distribution of climate risks (e.g., aging population and vulnerability of elderly people to weather extremes, such as heat waves). Embedding stronger emphasis on just transformation through Transformative Innovation will help to secure high-level political endorsement.

- Recognizing and avoiding of lock-ins and generation of new development paths (e.g., sewage system, transport system) shows characteristics of Transformative Innovation. This allows for effective CCA strategies that in the long-term phase out unsustainable models and replace them by more resilient ones.

3.2 Articulating instrument portfolios and defining synergies between funding sources

Espoo is using domestic and to some extent European funding to finance CCA projects. A lot of effort is put into creating conditions for making future developments climate resilient (e.g., take effects of climate change into account at the planning stage of public transport, update land-use plan based on flood analyses). Thereby, the city supports its goals with regulation instruments. Substantial efforts are also being made on building localised data and observatories, warning systems, tools to monitor and understand climate threats.

Espoo aims to minimize the harm and damage caused by climate change to residents, society, and the environment. Therefore, Espoo has established several projects to prepare for CCA. The actions are published online, and their progress can be tracked by the public. Espoo actively manages the discussion on CCA using communication experts and social media. The aim is to inform citizens and city employees about planned and completed CCA actions in the city. Transparent communication on CCA raises awareness of the reasons and necessity for CCA actions and thereby increases acceptance. This is especially important for CCA actions that contradict other public needs.

Espoo is planning the production of a podcast episode on CCA for the 'Safe Espoo' podcast series. The podcast will inform residents on CCA and raise awareness. The Helsinki Region Environmental Services Municipal Corporation (HSY) is responsible for information on climate change. For example, the HSY's 'Climate Info' guides and encourages citizens, housing companies and SMEs to adopt solutions (e.g., housing) that are climate-friendly and resilient towards climate change.

Espoo structures its climate adaptation projects into the categories of climate threats (see section 2.2.): (1) preparing for floods, heavy rain and storms, (2) preparing for heat waves, drought and forest fires, and (3) preventing the decline of natural biodiversity (Espoo Climate Watch – Climate Change Adaptation, 2023).

<u>Preparing for floods, heavy rain, and storms</u>

Climate change will increase rainfall and floods and, by extension, risks to the continuity and safety of traffic, waste storage and water treatment processes. Espoo is introducing over twenty projects to minimize the damage of floods, heavy rain, and storms. The projects focus on urban runoff and flood management, on permeable surfaces and identifying high-risk areas. The city also updates flood guidelines, proposes runoff management goals, and promotes the achievement of the goals.

Based on analysis Espoo has identified high-risk areas for flooding. These data are added to the internal service maps for city development and construction planning. In order to prepare for increasing flood risks, construction plans do not allocate new development in areas that may be subject to flooding from watercourses. This regulation not only prevents built areas to be flooded but also ensures that green areas surround watercourses. These green areas absorb water and prevent storm water from entering built areas.

Espoo is also promoting the use of the Greening Factor to guide the greening of neighbourhoods. The Greening Factor is a tool which was developed by Helsinki and describes the greening efficiency of a plot, i.e., the amount of different vegetation surfaces and storm water infiltration solutions on a plot in relation to the plot area. Espoo promotes the introduction of the Green Factor as a layer in its maps service for better management of storm water. The tool will help to track the quantity and quality of green spaces regarding their ability to absorb water in order to reduce urban flooding and improve storm water quality.

<u>Preparing for heat waves, drought, and forest fires</u>

Espoo is preparing for future heat waves by training and informing healthcare personnel and local residents and by addressing the heat regulation of built environments. Espoo considers heat island effects in city planning. To counteract the heat-island effect, Espoo relies on nature-based solutions and plants trees. To protect vulnerable groups (e.g., elderly people) during heat waves, the city trains healthcare personnel at the beginning of each warm season and prepares a guide on heat-sensitive diseases and medications. Additionally, Espoo is working on a heat wave warning system.

The city prepares for forest fires and other extreme weather events and their consequences by implementing a cooperation plan and emergency exercises together with Helsinki Regional Transport Authority (HSL), Helsinki Region Environmental Services Municipal Corporation (HSY) and the Rescue Department.

Preventing the decline of natural biodiversity

As a result of climate change, natural biodiversity is declining. At the same time, the deterioration of biodiversity reduces territory's ability to adapt to climate change. Therefore, Espoo wants to foster and increase biodiversity and is hence protecting natural reserves and creating corridors between those. Invasive species are one of the main threats to biodiversity, after habitat loss and fragmentation. Espoo is identifying the best methods to reduce the spread of invasive species through soil and garden waste. Additionally, Espoo monitors the spread of invasive species by entering affected areas into the city's internal mapping service. To identify the sites in existing protected areas that would most benefit from restoration, a habitat restoration mapping exercise is carried out.

3.2.1 Domestic instruments for climate action

In Finland's national climate adaptation plan 'Government Report on the National Climate Change Adaptation Plan until 2030' (2022) it states that the Ministry of Agriculture and Forestry, in cooperation with the Ministry of the Environment, will provide a package of approximately 20 million Euro for climate adaption.

3.2.2 EU instruments for climate change adaptation

Espoo has developed 'Espoo's integrated action plan for health-responsive blue-green infrastructure' (Environment and Building Control Department City of Espoo, 2022) as a result of the Health & Greenspace project co-funded by the EU Interreg under the URBACT program. This year (2023) Espoo has been selected as a lead partner of the Cities for Sustainability Governance (CSG) network under the URBACT program (Espoo - URBACT, 2023). The new URBACT network, further co-funded by the EU Interreg, will develop the strategic governance of European cities based on the UN's Sustainable Development Goals.

The Helsinki Metropolitan Area is an affiliate partner of Climate-KIC Nordic, a project co-funded by the EU. Climate-KIC is Europe's leading knowledge community working to address climate change through innovation. Research institutes, including the Finnish Environment Institute, the Natural Resources Institute Finland and the Finnish Meteorological Institute, develop tools that support regional adaptation work.

Box 2 provides good practices in articulating instrument portfolios and synergies between funding sources.

Box 2: Good practices for articulating instrument portfolios and synergies between funding sources

Incorporating instruments of different nature acting in synergy and maximizing co-benefits (e.g., setting goals supported by regulation and in communication with citizen supports goals). These instruments function as a systemic portfolio supporting Transformative Innovation for CCA.

3.3 Ensuring cross-domain synergies

Within the SECAP Espoo favours whole-of-government approaches by breaking silos. Several departments work together on strategic Climate Change Adaption goals, ensuring important topics are integrated into various projects and act in synergy. The communication department informs citizens about climate change risks and the efforts being made to overcome those risks. By emphasizing the necessity, the avoidance of negative effects and producing positive effects, the acceptance in public will increase.

In 2018, the Environmental Protection Service Department established a CCA working group in Espoo, consisting of experts from different service departments. The purpose of setting up the working group is to increase cooperation between the different departments on adaptation issues and to develop and coordinate adaptation measures. The CCA working group consists of members from the following departments: Environmental and Building Protection Department, City Planning Department, Urban Engineering Department, Rescue Department, Group Administration, and Finance and Economy Department.

Several departments are responsible for the CCA projects presented under 'Espoo Climate Watch'. Additionally to the departments listed above, the Public Works Department, Welfare and Health Department, and the Real Estate Department contribute to CCA projects. While few projects are implemented by a single department, most of them are implemented by several departments. Espoo uses project-based cross-department cooperation to unbreak silos. Some projects are implemented by the mayor's office. The involvement of the mayor signals high political endorsement.

Good practices in ensuring cross-domain synergies in the territory are shown in Box 3.

Box 3: Good practices in ensuring cross-domain synergies in the territory

- Establishing a whole-of-government approach to unbreak silos at strategic level (e.g., several departments work together on strategic Climate Change Adaption goals, ensuring important topics are integrated into various projects and act in synergy).

- Using good communication of implementation of CCA strategies to increase acceptance.

3.4 Increasing breadth and depth of stakeholder involvement

Stakeholder involvement is in place to achieve resilient storm water management. Citizens are informed about the importance and obligation of their contribution. The Climate Adaptation Work Group is working closely with the Institute of Meteorology and Aalto University on CCA. Health care facilities are also in the focus of cooperation to protect vulnerable groups from negative health effects caused by climate change (i.e., heat waves).

Citizen engagement

In built-up areas, storm water is rainwater, snowmelt or leaching water that flows from roofs or other impermeable surfaces and flows from plots in ditches, pipelines or storm water drains to streams, rivers, lakes and the sea. If the sewers are not able to take in all the storm water, a flood can occur.

The city of Espoo engages property owners in managing storm water to avoid sewer overflows. Espoo puts the responsibility of the treatment of storm water, which includes rainwater and meltwater, into the hands of property owners. Property owners are explained why their contribution is important. Thereby the functioning of sewage systems and the risks of sewage overflows are introduced (e.g., weaken the quality of surface and groundwater and destroy biological communities). Citizens are provided with information (e.g., website and videos – see Fig.3) on how to manage storm water on their property (e.g., open ditches, boundary ditches, and storm water pipes).

Figure 3: Illustration of open ditch technique to manage storm water by the citizens.

Source: screenshot of video published by HSY on youtube.com

Preparing citizens for extreme weather events

Espoo is preparing its citizens for emergency situations by providing useful information. The city has published an emergency supply kit and obligates residential buildings, with at least five residential apartments, to have a written emergency plan for self-preparedness. Information on what the plan should include is also duly provided.

Espoo educates its citizens who are not used to heat waves in these areas about the consequences and what they can do. The appearance of ticks and blue-green algae increases. Citizens are asked to take tick vaccines, protect themselves with long-sleeved clothes and learn to identify blue-green algae (Espoo - Climate Change Adaptation, 2023).

Multi-stakeholder collaboration

Beyond citizens, the city of Espoo recognizes the importance of non-city stakeholders (i.e., hospitals, care centres, schools, universities, and companies).

The CCA work of the city of Espoo is carried forward and developed by the CCA working group established in 2018. The strengths of the city's adaptation work include close cooperation with research institutes and universities, such as the Institute of Meteorology and Aalto University.

To protect vulnerable groups, such as elderly people, the city of Espoo cooperates health centres to train care staff at the beginning of every warm season to treat these groups effectively. The city also retains data from elderly facilities on means for cooling, adequate hydration and sun protection (SECAP, 2019).

A set of good practices for increasing breadth and depth of stakeholder involvement in the Espoo is shown in the Box 4.

Box 4: Good practices for increasing breadth and depth of stakeholder involvement

- Motivating and obligating citizen to install nature-based solutions on private land (e.g., property owners need to install solutions for storm water management on private property). Stakeholder involvement in CCA interventions supports increased emphasis on TI.

- Harnessing the power of interdisciplinary research and innovation to contribute to cross-domain synergies (e.g., established CCA working group that works in close cooperation with research institutes and universities).

- Seeking wider and inclusive societal transformation through involvement of vulnerable groups (e.g., cooperation with health centres and elderly homes). Including vulnerable groups allows for a more socially just transformative CCA.

3.5 Setting up effective multi-level governance models

The city of Espoo is planning and executing its CCA strategy in line with the regional, national, and European strategic and legal frameworks. In practice CCA actions are implemented by local authorities, who propose projects directly to the national, and European governance level. Through the HSY there is a strong cross-municipality cooperation between Espoo, Helsinki, Vantaa, and Kauniainen on CCA. The HSY takes over the more strategic joint tasks, so that the municipalities do not need to address them on their own (e.g., providing information on climate change, monitoring and reporting of adaptation work).

The city of Espoo is planning and executing its CCA strategy in line with the regional (Helsinki Metropolitan Area), national and European strategic and legal frameworks. To align the city's strategy with European efforts, the city has signed the EU Mission to 'Adaption to Climate Change' and the Covenant of Majors (see section Goals and Scope Definition). Additionally, the city has been chosen as one of the 100 Climate-Neutral and Smart Cities by 2030.

In Espoo, work related to CCA is done in close cooperation with other municipalities in the capital region and HSY. The city is implementing a joint CCA strategy drawn up for the capital region. The implementation of the adaptation strategy is monitored by the ILSE working group consisting of representatives of the cities of the capital region, HSL (Helsinki Regional Transport Authority), HSY and the Greater Helsinki municipalities. The reporting of adaptation work is carried out in Espoo through HSY.

The responsibilities between the HSY and Espoo are well defined. While the HSY is preparing data (e.g., the social vulnerability to floods and heat and water supply preparation for exceptional weather phenomena has been investigated in the capital region by HSY), developing adaptation measures and their effectiveness and monitoring the adaptation work, Espoo is responsible to implement CCA actions (SECAP). Espoo is also responsible for updating city data (e.g., internal maps) with data provided by HSY to ensure evidence-based decision-making.

Good practices for setting up effective multi-level governance models in Espoo are shown in Box 5.

Box 5: Good practices for setting up effective multi-level governance models

- The city of Espoo is planning and executing its CCA strategy in line with the regional, national, and European strategic and legal frameworks.

- Strong cross-municipality cooperation between Espoo, Helsinki, Vantaa, and Kauniainen on CCA coordinated by the HSY.

- Tasks of cities and HSY well defined: While the HSY is preparing data, developing adaptation measures and their effectiveness and monitoring the adaptation work, Espoo is responsible to implement CCA actions.

3.6 Making room for experimentation

There is limited experimentation on innovative CCA solutions in Espoo. In one specific project though, a wide range of experiments was conducted to test the effects of blue-green infrastructure on the health of participants.

Espoo has developed an integrated action plan for health-responsive blue-green infrastructure as a result of the 'Health & Greenspace' project. In this project, the cities aimed to improve urban green-spaces in order to promote mental and physical health and social interaction in green spaces. The project also investigated how vegetation in the urban environment can respond to various health risks, such as heat stress or air and noise pollution in cities. The project allowed for a wide range of experiments to test the effects of blue-green infrastructure on the health of participants (Espoo's integrated action plan for health-responsive blue-green infrastructure, 2022). However, the main aim of those experiments did not focus on CCA, but rather on the health effect of green-blue infrastructure in general. Overall, experimentation does not yet play a big role in the climate adaptation strategy of Espoo. A reason might be that many projects on CCA are in the phase of data collection and preparing for actions.

Good practice regarding making room for experimentation in Espoo is shown in Box 6.

Box 6: Good practice regarding making room for experimentation in Espoo

- Testing the effects of blue-green infrastructure on the health of participants was built on the experimentation approach.

3.7 Securing high levels of policy intelligence, learning and strategic capacity

In order to develop an evidence based CCA strategy and build a policy portfolio, a strong knowledge base has been established by joining forces with the HSY. Many of the Espoo climate adaptation projects aim to further develop the knowledge base to evaluate climate risks and monitor the development of risks and the effects of installed counter measures. The development of a strong knowledge base and the strategic documents (SECAP; Action Plan for CCA in Espoo 2022–2025; Espoo Climate Watch) signals strong strategic capacities. The climate adaptation projects also have a strategic character. The majority of projects focus on further developing the knowledge base, monitoring, informing, planning, promoting and analysing. Still, the interdisciplinary research is not in the focus of CCA actions in Espoo. To manage transitions, as necessary companions to the transformative innovation approach, more interdisciplinary research is needed.

3.7.1 Establishing a knowledge base for CCA

The city of Espoo is putting great efforts into monitoring climate change impacts and collecting data on CCA measures. The city of Espoo has collected data on flood runoff. The identified risk areas from the flood modelling will be entered into the city's internal mapping service. These maps are used, for example, to determine construction areas. Based on the data the city provides the urban center with flood runoff route analyses and updates flood guidelines. To keep track of green areas, Espoo registers completed green roof structures and implements a green roof and green wall level for the city's internal map service. These measures aim to make green roof structures part of normal construction practices. This data collection provides a holistic picture of the green spaces and flood runoff in the city and allows for stronger, evidence-based justification for necessary and bold CCA interventions (including regulation).

3.7.2 Strategic capacity

The established knowledge base has been used by the city of Espoo to develop the SECAP. The development of the Climate Adaptation Plan required strategic capacity. The city of Espoo shows learning capacities by constantly enlarging its knowledge base (e.g., updating internal map service with green roofs, flood runoffs). Based on the SECAP, the CCA working group has developed an 'action plan for climate change adaptation in Espoo 2022–2025'. The implementation of the measures listed in SECAP has been broken down into tasks, which have been compiled into an action plan. The action plan commits the city to the implementation of tasks that improve preparation and adaptation to climate change. Espoo published its climate adaptation projects online under 'Espoo Climate Watch'. Besides a project description, Espoo names the main project characteristics (timeline, progress status, responsible authorities, climate change risks, sustainable development goals). The development of a strong knowledge base and the strategic documents (SECAP; Action Plan for Climate Change Adaptation in Espoo 2022–2025; Espoo Climate Watch) signals strong strategic capacities. The climate adaptation projects also have a strategic character. The majority of projects focus on further developing the knowledge base, monitoring, informing, planning, promoting and analyzing.

Good practice on securing high levels of policy intelligence and strategic capacity in the city is shown in Box 7.

Box 7: Good practice in securing high levels of policy intelligence, learning and strategic capacity

- Establishing a strong knowledge base in joint forces with the HSY. A robust evidence base helps to understand the baseline situation signals a transformative innovation perspective on CCA.

4 Conclusions

By becoming a signatory of the EU Mission on CCA, Espoo has committed to building climate resilience in an inclusive way, engaging with local stakeholders, the civil society, the business community, industry, research organisations, and citizens. Features from the transformative innovation approach can support the city in its efforts towards systemic changes that are needed for effective CCA. To achieve transformative CCA, there is a powerful role to be played by innovation for developing 'out-of-the box' transformative CCA solutions, tailored to territories' needs and opportunities.

4.1 Possible Ways Forward

The main conclusions arising from each of the seven key transformative innovation features of the analytical framework are stated below. Under each of these features, possible ways forward towards a transformative CCA approach are suggested for the territory.

1. Directionality

Formulating its goals, Espoo incorporates societal challenges (e.g., aging population and vulnerability of elderly people to weather extremes, as such heat waves). The focus on a just transformation helps to secure high-level political endorsement. In the storm water management, Espoo considers a system change (e.g. acknowledging that storm water does not need to be transported via the sewage system but considering alternatives such as green spaces, open and boundary ditches). Espoo acknowledges the importance of the business sector adaptation efforts, which can potentially act as a testing ground for new solutions.

However, there is a lack of innovative solutions towards climate reliance, as well as of tangible goals for some other climate resilience activities that can be quantified and monitored. Espoo has a strong database on climate and territorial data, which can be used to set and track noticeable goals (e.g., green surfaces, amount of storm water that can be absorbed by the city). Additionally, Espoo's innovation ecosystem is considered a leading innovation hub in the Nordic countries. The city could use its innovation ecosystem to work on various innovative solutions tackling its the biggest CCA challenges.

Possible ways forward:

- Set tangible goals for the additional climate resilience challenges (apart from the resilient storm water management) in the city of Espoo that can be quantified and monitored (e.g. for green spaces, climate-smart housing)
- Emphasize the need for innovative CCA approaches and coordinate with innovation hubs (e.g. Espoo's Centre of Excellence for Sustainable Development).
- Maintain the sense of urgency for CCA. To overcome the long-term and uncertain perspective on CCA, simulation and prediction instruments can help (e.g. calculate and communicate the deficit of green and permeable surfaces to absorb storm water precipitations for different scenarios).
- Integrate transformative objectives for CCA into relevant strategic documents under preparation and emphasise the need for more systemic and innovative CCA solutions.

2. Articulating instrument portfolios and defining synergies between funding sources

Espoo is using domestic and to some extent European funding to finance CCA projects. A lot of effort is put into creating conditions for making future developments more climate resilient (e.g., take effects of climate change into account at the planning stage of public transport infrastructure, update land-use plan based on flood analyses) and support them through regulation instruments. Substantial efforts are also being made on building localised data and observatories, warning systems, tools to monitor and understand climate threats.

Possible ways forward:

- Expand the policy portfolio for Climate Change Adaption by European funds for innovation (e.g., ERDF, Horizon, Smart Specialization Strategy).
- Establish structures to systematically investigate synergies of existing and potential portfolio instruments.
- Support research and innovation oriented towards CCA solutions in national innovation programmes.
- Ensure private sector involvement to allow new market creation, through the use of public procurement and incentives (e.g. provide incentives to citizens and companies for climate adaptive actions like green roofs and walls; incentives should stimulate demand, which in turn should increase the supply for green roofs and walls, i.e. foster an economy around climate adaptation).

3. Ensuring cross domain synergies

Within the SECAP Espoo favours whole-of-government approaches by breaking silos. Several departments work together on strategic Climate Change Adaption goals, ensuring important topics are integrated into various projects and act in synergy. Informing citizens about risks and how to overcome them should stimulate public endorsement of CCA actions.

Possible ways forward:

- Foster inter-disciplinary research and integrate the results into CCA projects to contribute further to cross-domain synergies.
- Exploit the potential of 'climate adaptation economy' to bring in business-oriented innovation instruments in the portfolio.
- Investigate if there are any silos at the strategic level.

4. Increasing breadth and depth of stakeholder involvement

Stakeholder involvement is in place to achieve resilient storm water management. Citizens are informed about the importance of their contribution. The Climate Adaptation Work Group is working closely with the Institute of Meteorology and Aalto University on CCA. Health care facilities are also in the focus of cooperation to protect vulnerable groups from negative health effects caused by climate change (i.e. heat waves).

Possible ways forward:

- Establish mechanisms (incentives, procurement) to ensure strong business involvement and foster a 'climate adaptation economy'.

- Include citizens at the strategic level, e.g., through workshops where different resilience levels are discussed under defined goals.
- Set up challenges for citizens to find CCA solutions in their districts to mobilize local environmental knowledge and understand socio-cultural factors.
- Transfer good practices built up under Espoo's innovation ecosystem for climate mitigation towards CCA.

5. Setting up effective multi-level governance models

The city of Espoo is planning and executing its CCA strategy in line with the regional, national, and European strategic and legal frameworks. In practice CCA actions are implemented by local authorities, who propose projects directly to the national and European governance level. Through the Helsinki Region Environmental Services Municipal Corporation (HSY) there is a strong cross-municipality cooperation between Espoo, Helsinki, Vantaa, and Kauniainen on CCA. The HSY takes over common framework generic tasks, so that the municipalities do not need to address them individually on their own (e.g. providing information on climate change, monitoring and reporting of adaptation work).

Possible ways forward:

- Recognize the limited range of responsibilities and corresponding powers of local authorities as a barrier for transformative CCA strategies. Support and empower local authorities to overcome these barriers.
- Consider trade-offs between the institutionalisation of multi-level governance systems and their flexibility in the context of 'system change' implicit in transformative innovation approaches.

6. Making room for experimentation

There is limited experimentation on innovative CCA solutions in Espoo. In one specific project though, a wide range of experiments were conducted to test the effects of blue-green infrastructure on the health of participants.

Possible ways forward:

- Integrate Espoo's innovation culture in CCA projects.
- Invite companies to test their solutions for CCA on buildings and properties. Signal tolerance to failure.
- Reinforce regulatory sandbox initiatives relevant to innovative CCA.

7. Securing high levels of policy intelligence, learning and strategic capacity

In order to develop an evidence based CCA strategy and build a policy portfolio a strong knowledge base has been established in joint forces with the HSY. Many of the Espoo climate adaptation projects aim to further develop the knowledge base to evaluate climate risks and monitor the development of risks and the effects of installed counter measures.

The development of a strong knowledge base and the strategic documents (SECAP; Action Plan for CCA in Espoo 2022–2025; Espoo Climate Watch) signals strong strategic capacities. The climate

adaptation projects also have a strategic character. The majority of projects focus on further developing the knowledge base, monitoring, informing, planning, promoting and analyzing.

Interdisciplinary research is not in the focus of CCA actions in Espoo. To manage transitions, as necessary companions to the transformative innovation approach, more interdisciplinary research is needed in the territory.

Possible ways forward:

- Foster interdisciplinary research to build up transition skills. Social and behavioural sciences would need to complement knowledge produced by climate scientists and the solutions developed by engineers.
- Support local authorities in putting their strategic plans into action. Providing information on funding opportunities for implementing bold, innovative projects.
- Support local authorities' abilities for long-term planning under uncertainty as it is a key enabler for transformative innovation (e.g., consider allowing CCA strategies beyond legislative periods).

References

Documents

Action plan for climate change adaptation in Espoo 2022–2025, Espoo Climate Change Adaptation Working Group (2022). https://espoo.oncloudos.com/kokous/2022667-6-137192.PDF

Espoo's Integrated Action Plan for health-responsive blue-green infrastructure, Environment and Building Control Department City of Espoo (2022). https://urbact.eu/sites/default/files/2022-12/Espoo´s%20Integrated%20Action%20Plan%20for%20health-responsive%20blue-green%20infrastructure_WEB_ENG_accessible.pdf

European Commission, European Commission's Joint Research Centre, Harding, R., Nauwelaers, C. and Haegeman, K., *Transformative Innovation for Climate Change Adaptation - A mapping-based framework for territories*, Carat, G., Gnamus, A. editor(s), Publications Office of the European Union, Luxembourg, 2024, JRC137300: https://publications.jrc.ec.europa.eu/repository/handle/JRC137300

Government Report on the National Climate Change Adaptation Plan until 2030, Ministry of Agriculture and Forestry (2022). https://mmm.fi/delegate/file/113950

Helsinki Metropolitan Area Climate Change Adaptation Strategy, HSY (2012). https://ilmastotyokalut.fi/files/2014/10/11_2012_Helsinki_Metropolitan_Area_Climate_Change_Adaptation_Strategy.pdf

Sustainable Energy and Climate Action Plan of the city of Espoo (SECAP), City of Espoo (2019).

The new challenges of adapting to climate change in the capital region, HSY (2017). https://www.hsy.fi/globalassets/ilmanlaatu-ja-ilmasto/tiedostot/pks_ilmastonmuutokseen_sopeutumisen_uudet_haasteet.pdf

EU Mission: Adaptation to Climate Change, European Union (2023). https://research-and-innovation.ec.europa.eu/system/files/2023-05/ec_rtd_eu-climate-mission-meet-the-regions.pdf

EU Mission: 100 climate-neutral and smart cities, European Commission (2022). https://op.europa.eu/en/publication-detail/-/publication/822ee360-c9bf-11ec-b6f4-01aa75ed71a1/language-en/format-PDF/source-256649647

Projects (selection)

Analysis of climate risks on traffic, retrieved: 12.10.2023. https://ilmastovahti.espoo.fi/en/actions/a6b60

City communication on adaptation measures, retrieved: 12.10.2023. https://ilmastovahti.espoo.fi/en/actions/a2d5c

EIT Climate-KIC in the Nordics, retrieved: 12.10.2023. https://nordic.climate-kic.org/who-we-are/climate-kic-in-the-nordics/

Episode on climate change adaptation for the Safe Espoo podcast series, retrieved: 12.10.2023. https://ilmastovahti.espoo.fi/en/actions/ae552

Heat wave warning system, retrieved: 12.10.2023. https://ilmastovahti.espoo.fi/en/actions/a3792

Including strength of heat island effects in city planning, retrieved: 12.10.2023. https://ilmastovahti.espoo.fi/en/actions/a3c2b

Register on completed green roof structures, retrieved: 12.10.2023. https://ilmastovahti.espoo.fi/en/actions/acd79

Runoff route analyses for urban centers, retrieved: 12.10.2023. https://ilmastovahti.espoo.fi/en/actions/a0769

Training of health-care personnel at the beginning of every warm season, retrieved: 12.10.2023. https://ilmastovahti.espoo.fi/en/actions/a39a5

Websites (selection)

Biogeographical regions in Europe, European Environmental Agency (EEA) (2017), retrieved: 12.10.2023. https://www.eea.europa.eu/data-and-maps/figures/biogeographical-regions-in-europe-2

Covenant of Mayors – Europe, European Commission, retrieved, 13.10.2023. https://eu-mayors.ec.europa.eu/en/home

Espoo – Climate Change Adaptation, City of Espoo, retrieved: 12.10.2023. https://www.espoo.fi/en/climate-change-adaptation#how-can-you-prepare-for-climate-change-21411

Espoo's Climate Goals, City of Espoo, retrieved: 12.10.2023. https://www.espoo.fi/en/kestava-kehitys/espoos-climate-goals#covenant-of-mayors-for-climate-and-energy-10222

Espoo Climate Watch, City of Espoo, retrieved: 12.10.2023. https://ilmastovahti.espoo.fi/en

Espoo Climate Watch – Climate Change Adaptation, City of Espoo, retrieved: 12.10.2023. https://ilmastovahti.espoo.fi/en/categories/sopeutuminen

Espoo Innovation Ecosystem: open collaboration strategies in practice, European Commission, retrieved: 12.10.2023. https://ec.europa.eu/research-and-innovation/en/research-area/industrial-research-and-innovation/eu-valorisation-policy/knowledge-valorisation-platform/repository/espoo-innovation-ecosystem-open-collaboration-strategies-practice

Espoo selected to implement EU Mission on climate-neutral and smart cities together with other pioneers, City of Espoo (28.04.2022), retrieved, 13.10.2023. https://www.espoo.fi/en/news/2022/04/espoo-selected-implement-eu-mission-on-climate-neutral-and-smart-cities-together-other-pioneers

Espoo was selected as the lead partner for an URBACT network, City of Espoo (22.06.2023), retrieved: 12.10.2023. https://www.espoo.fi/en/news/2023/06/espoo-was-selected-lead-partner-urbact-network

EU Adaptation Strategy, European Commission, retrieved: 12.10.2023. https://climate.ec.europa.eu/eu-action/adaptation-climate-change/eu-adaptation-strategy_en

EU Mission: Adaptation to Climate Change, European Commission, retrieved: 12.10.2023. https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/adaptation-climate-change_en#:~:text=The%20EU%20Mission%20on%20Adaptation,and%20plan%20for%20climate%20resilience

Helsinki Region Environmental Services (HSY), HSY, retrieved: 12.10.2023. https://www.hsy.fi/en/

How to manage storm water correctly – Open ditch, HSY, retrieved: 12.10.2023. https://www.youtube.com/watch?v=OlW-FxvaMog

Innovation Initiatives, City of Espoo, retrieved: 12.10.2023. https://www.espoo.fi/en/city-espoo/innovative-espoo/innovative-initiatives

Open Street Map, retrieved: 12.10.2023. https://www.openstreetmap.org/#map=6/51.330/10.453

URBACT – Health & Greenspace, URBACT, retrieved: 12.10.2023.
https://urbact.eu/networks/healthgreenspace

List of abbreviations

CCA Climate Change Adaptation

EIA Environmental Impact Assessment

HSL Helsinki Regional Transport Authority

HSY Helsinki Region Environmental Services Municipal Corporation

JRC Joint Research Center

NAP National Adaptation Plan

R&D Research and development

R&I Research and innovation

SECAP Sustainable Energy and Climate Action Plan

List of boxes

List of figures

Annexes

Annex 1: List of interviews

Date	Interviewee	Position
	City Council of Espoo	
10..2023	Meri Löyttyniemi	Member of the City Council of Espoo, Vice-chair of Green Group, Chair of Sustainable Espoo Aalto University, Senior sustainability advisor Member of Helsinki-Uusimaa Regional Council
10.2023	**Helsinki-Uusimaa Regional Council**	
	Heikki Kallasvaara	Senior Advisor
	Salla Siivonen	Project Manager for Climate Change Adaptation
	Pia Tynys	Chief Adviser for Climate Change
10.2023	**City of Espoo, Mayor's Office**	
	Rosa Vaisanen	Specialist for Sustainable Urban Development

Annex 2: List of case studies

Case studies have been carried out to analyse to what extent and how enabling factors towards 'Transformative Climate Change Adaptation' strategies, as identified in the conceptual report (European Commission, 2024), are at play in reality, and what can be done to overcome barriers in various territorial contexts. The methodological framework described in the conceptual report essentially acts as a practical guide for undertaking cases studies on CCA strategies in different territories, in a uniform way. These case studies are listed below:

"Transformative innovation for better climate change adaptation" – Case studies

Country	Territory	URL (*)	DOI	JRC number
Belgium	Leuven	https://publications.jrc.ec.europa.eu/repository/handle/JRC137313	10.2760/58125	JRC137313
Finland	Espoo	https://publications.jrc.ec.europa.eu/repository/handle/JRC137316	10.2760/177322	JRC137316
Finland	Turku - Southwest Finland	https://publications.jrc.ec.europa.eu/repository/handle/JRC137315	10.2760/211155	JRC137315
France	Provence-Alpes-Côte d'Azur	https://publications.jrc.ec.europa.eu/repository/handle/JRC137314	10.2760/46893	JRC137314
Greece	Attica and North Aegean regions	https://publications.jrc.ec.europa.eu/repository/handle/JRC137322	10.2760/493562	JRC137322
Iceland		https://publications.jrc.ec.europa.eu/repository/handle/JRC137291	10.2760/305796	JRC137291
Italy	Emilia-Romagna	https://publications.jrc.ec.europa.eu/repository/handle/JRC137319	10.2760/790200	JRC137319
Netherlands	Northern Netherlands	https://publications.jrc.ec.europa.eu/repository/handle/JRC137312	10.2760/10862	JRC137312
Poland	Mazovia - Stare Babice	https://publications.jrc.ec.europa.eu/repository/handle/JRC137323	10.2760/58125	JRC137323
Portugal	Norte	https://publications.jrc.ec.europa.eu/repository/handle/JRC137321	10.2760/399394	JRC137321
Romania	Nord Vest - Cluj	https://publications.jrc.ec.europa.eu/repository/handle/JRC137317	10.2760/923916	JRC137317
Slovenia	Gorenjska	https://publications.jrc.ec.europa.eu/repository/handle/JRC137320	10.2760/502482	JRC137320
Spain	Andalucia - Granada	https://publications.jrc.ec.europa.eu/repository/handle/JRC137324	10.2760/104672	JRC137324.
Sweden	Blekinge and Värmland	https://publications.jrc.ec.europa.eu/repository/handle/JRC137318	10.2760/249067	JRC137318

(*) Links may give error message for those studies still under publication

Getting in touch with the EU

In person

All over the European Union there are hundreds of Europe Direct centres. You can find the address of the centre nearest you online (european-union.europa.eu/contact-eu/meet-us_en).

On the phone or in writing

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

— by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),

— at the following standard number: +32 22999696,

— via the following form: european-union.europa.eu/contact-eu/write-us_en.

Finding information about the EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website (european-union.europa.eu).

EU publications

You can view or order EU publications at op.europa.eu/en/publications. Multiple copies of free publications can be obtained by contacting Europe Direct or your local documentation centre (european-union.europa.eu/contact-eu/meet-us_en).

EU law and related documents

For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex (eur-lex.europa.eu).

EU open data

The portal data.europa.eu provides access to open datasets from the EU institutions, bodies and agencies. These can be downloaded and reused for free, for both commercial and non-commercial purposes. The portal also provides access to a wealth of datasets from European countries.

Science for policy

The Joint Research Centre (JRC) provides independent, evidence-based knowledge and science, supporting EU policies to positively impact society

EU Science Hub
joint-research-centre.ec.europa.eu

Publications Office
of the European Union