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LESSONS FROM OECD COUNTRIES

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ABSTRACT

Since the first OECD country published its national adaptation strategy in 2005, there has been a marked increase in national planning for climate change adaptation. This paper provides an overview of national adaptation planning activity across OECD countries and identifies some of the emerging lessons that have been learnt from their experiences.

The analysis draws on three main sources of information: a survey of countries' national communications to the UN Framework Convention on Climate Change (UNFCCC); three country case studies (Mexico, England and the United States); and the results of a Policy Forum on Adaptation hosted by the OECD in 2012. It finds that twenty-six OECD countries have developed or are currently developing strategic frameworks for national adaptation and seventeen of those countries have also produced or are working on detailed national adaptation plans. Countries have made significant investments in building an increasingly sophisticated evidence base to support adaptation, and to build adaptive capacity. National governments have commonly established policies to mainstream adaptation into government operations and regulatory systems, and established co-ordination mechanisms to ensure action across government. Local and regional governments have also played significant roles in adaptation efforts, though less progress has been made in establishing systematic approaches to co-ordination between national and sub-national governments.

The development of strategies and plans has occurred recently, with implementation still at an early stage. Nonetheless, the case studies and OECD workshop revealed three key challenges faced by countries as they have started to implement their strategies and plans: overcoming climate information shortcomings and associated capacity constraints; securing adequate financing; and measuring the success of adaptation interventions. Action to address these constraints will be vital to ensuring that progress in planning translates into improvements in outcomes.

JEL Classification: Q54, Q58, H10, H12

Keywords: Adaptation, climate change, national planning, risk management

RÉSUMÉ

Depuis la publication de la première stratégie nationale d'adaptation par un pays de l'OCDE en 2005, les activités de planification nationale de l'adaptation au changement climatique se sont multipliées. Le présent document propose un panorama de ces activités dans les différents pays de l'OCDE et met en exergue un certain nombre d'enseignements nouveaux qui se dégagent de leur expérience.

L'analyse met à profit trois principales sources d'informations : une étude des communications nationales à la Convention-cadre des Nations Unies sur les changements climatiques (CCNUCC), trois études de cas nationales (Mexique, Angleterre et États-Unis) et les résultats du Forum sur l'adaptation au changement climatique tenu en 2012 à l'invitation de l'OCDE. Elle montre que 26 pays de l'OCDE ont élaboré ou sont en train d'élaborer des cadres stratégiques nationaux pour l'adaptation, et que 17 d'entre eux ont également produit des plans d'adaptation nationaux détaillés ou y travaillent. Les pays ont beaucoup investi pour constituer un socle de connaissances de plus en plus perfectionné, afin d'étayer leurs mesures d'adaptation et de renforcer leurs capacités en la matière. Les gouvernements nationaux ont généralement adopté des mesures visant à assurer une prise en compte systématique de l'adaptation dans leurs activités et dans les dispositifs réglementaires, et mis en place des mécanismes de coordination pour que des dispositions soient prises dans l'ensemble de l'administration. Les collectivités locales et les régions ont également joué un rôle important dans les efforts d'adaptation, même si la mise en place de cadres de coordination systématique entre les autorités nationales et infranationales a moins bien progressé.

L'élaboration de stratégies et de plans est relativement récente et leur mise en œuvre en est encore aux premiers stades. Les études de cas et l'atelier de l'OCDE ont néanmoins permis de constater que les pays doivent relever trois grands défis au moment de mettre en application leurs stratégies et leurs plans : surmonter le déficit d'informations sur le climat et l'insuffisance des capacités correspondantes, mobiliser un financement adéquat et mesurer l'efficacité des interventions d'adaptation. Il sera primordial de s'attaquer à ces difficultés pour faire en sorte que les avancées en matière de planification se traduisent par de meilleurs résultats.

Classification JEL: Q54, Q58, H10, H12

Mots-clé : Adaptation, Changement climatique, Planification nationale, Gestion des risques

FOREWORD

This report on "National Adaptation Planning: Lessons from OECD Countries" has been overseen by the Working Party on Climate, Investment and Development (WPCID).

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LIST OF ACRONYMS

ASC	(United Kingdom) Adaptation Sub-Committee
DAB	(English) Domestic Adaptation Board
DOI	(United States) Department of the Interior
CCRA	(English) Climate Change Risk Assessment
CEQ	(United States) White House Council on Environmental Quality
CICC	(Mexican) Interministerial Climate Change Commission
DAP	(English) Departmental Adaptation Plan
Defra	(United Kingdom) Department for Environment, Food and Rural Affairs
DOT	(United States) Department of Transportation
ENACC	(Mexican) National Climate Change Strategy
EO	Executive Order
EPA	(United States) Environmental Protection Agency
FHWA	(United States) Department of Transportation Federal Highway Administration
GHG	Greenhouse Gas
INE	(Mexican) National Institute of Ecology (Instituto Nacional de Ecología)
IPCC	Intergovernmental Panel on Climate Change
M&E	Monitoring and Evaluation
NAP	(English) National Adaptation Programme
NC	National Communication (report to the UNFCCC)
NCA	(United States) National Climate Assessment
NGO	Non-Governmental Organisation
NOAA	(United States) National Oceanic and Atmospheric Administration
OECD	Organisation for Economic Co-operation and Development
OSTP	(United States) White House Office of Science and Technology Policy
OW	(United States) EPA Office of Water
PECC	(Mexican) Special Programme on Climate Change
PND	(Mexican) National Development Plan
UKCIP	United Kingdom Climate Impacts Programme
UKCP09	United Kingdom Climate Projections (2009)
UNFCCC	United Nations Framework Convention on Climate Change
USGCRP	United States Global Change Research Program

EXECUTIVE SUMMARY

Decisions made by national governments will be vital in determining their countries' success at preparing for the effects of a changing climate. This can be through action, such as raising awareness of the likely effects of climate change, or inaction in the face of policies that provide the wrong incentives to individuals or businesses. Examples of the latter include insurance schemes that encourage excessive development in high-risk areas, or under-pricing of resources that will become scarcer in the future. Increasingly, OECD country governments are undertaking national adaptation planning to provide an evidence-based, co-ordinated and systematic approach to their preparations for climate change.

This paper brings together three strands of evidence to provide an assessment of national planning in OECD countries: a survey of OECD countries' most recent National Communications (NCs) to the UN Framework Convention on Climate Change (UNFCCC); case studies of Mexico, the United Kingdom and United States; and, the results of a workshop on national adaptation planning hosted by the OECD in May 2012.

Progress in national adaptation planning

There has been a step change in the level of activity on adaptation reported by OECD countries in their National Communications. This can be seen by comparing the most recent set of NCs with those surveyed by Gagnon-Lebrun and Agrawala (2006). During the past six years, the number of OECD countries identifying possible adaptation options in their NCs rose from 16 to 31, while those mentioning policies synergistic with adaptation increased from 13 to 27. Specific adaptation policies or the modification of existing policies to include adaptation are now mentioned by 27 countries, compared with only 5 in the 2006 study. These figures only include the progress occurring prior to the publication of the most recent NCs in 2009 or 2010, and there have been further developments since then.

National adaptation strategies and plans have been the main tool used by OECD countries for structuring and communicating their national adaptation planning activities. Of the 34 OECD member countries, 18 have published strategies for adaptation. Ten of these countries have also produced detailed adaptation plans setting out concrete measures and policies. A small number of countries have chosen to implement adaptation actions at the national level without adopting a formal strategy or plan.

The evidence used to underpin national level planning has become increasingly sophisticated. Across OECD countries, sustained investment in research has yielded improved projections of climate change, providing higher levels of spatial detail and more explicit treatment of uncertainty. There has also been significant progress in translating these projections into impacts relevant to policy-makers, such as changes in agricultural productivity and health impacts. These range from qualitative overviews, such as the national assessment undertaken by Canada in 2007 using a combination of literature review and expert judgement, to the United Kingdom's Climate Change Risk Assessment, which provides a quantitative assessment of the main risks and opportunities.

National strategies have largely followed the model established by Finland in 2005, which focused on mainstreaming adaptation into existing government activities and regulatory frameworks. Within this overall model, the most common approach has been to pursue sectoral adaptation programmes that align adaptation duties with existing ministerial responsibilities, combined with additional efforts to address cross-cutting issues, such as water and infrastructure. This is complemented with the creation of formal co-ordination mechanisms – such as high-level steering groups, or working-level co-ordination units. Responsibility for this has typically been located in environment ministries, with a few countries choosing to locate it in a central ministry or the executive office. Within these overall approaches, the details of

implementation have reflected national circumstances – this analysis suggests that there is no single best approach for all countries to emulate.

Co-ordination and encouragement of action by local and state governments has played a significant role in OECD countries national planning processes, with the methods adopted varying by countries' political systems. Many impacts of climate change – such as flooding, heat waves and sea level rise – will be location specific, added to which the legislative competence for addressing them lies at the sub-national level. Countries frequently highlight specific regional- and local-level adaptation initiatives in their NCs. However, technical capacity and limited resources to implement adaptation are a constraint to scaling-up action beyond pioneering initiatives. Recognising this, co-ordinating and enabling action across multiple levels of governance is a central theme of most national planning process.

OECD governments' have also recognised the importance of engaging businesses and civil society in national planning processes. While self-interest should theoretically provide sufficient motive for individuals and organisations to adapt, there are a number of potential barriers to action (Agrawala *et al*., 2011). Several countries' NCs and the discussion at the Policy Forum emphasised the need to understand these potential constraints and opportunities, as an input into national plans. To achieve this, a common feature of national adaptation planning has been the establishment of comprehensive consultation processes. For example, Austria sought additional stakeholder input for its national planning through expert consultation, an extensive round of workshops with relevant organisations and internet-based engagement with the general public. Countries with indigenous populations set up specific processes for ensuring their input in national planning processes.

From planning to implementation: key challenges

The development of strategies and plans has occurred recently, with implementation still at an early stage. Nonetheless, the case studies and OECD workshop revealed three key challenges faced by governments as they have begun to put their plans and strategies into practice.

The first major challenge is to bridge the gap between the needs of decision makers and the available evidence and tools. Despite the significant developments in the evidence base for adaptation, there are still gaps between the climate information generated through existing research processes and the information needed by end users (in both the public sector and the private sector). This is both because it is not yet technically feasible to meet some of those needs, and also because the data that are available can be complicated and difficult to apply. Continuing improvements in the technical quality of climate change data need to be matched by an understanding of end users' needs and by capacity-building efforts to make climate data more easy to use in decision-making contexts. In achieving this, there needs to be careful consideration of the potential roles of the public and private sectors in strengthening the link between evidence and decision-making.

Ensuring that adequate financial resources are available for adaptation is the second key challenge to implementation. The majority of strategies and plans do not explicitly discuss funding requirements and sources in their national plans or strategies. France's plan is unusual in that it clearly identified the costs of measures in its national adaptation plan, while several others have clarified that adaptation is intended to be funded through standard budgetary processes. One of the reasons for this situation is the lack of data on costs and benefits, which makes it difficult to estimate likely funding requirements at the outset. A further reason suggested at the OECD Policy Forum was that upfront discussion of costs was perceived as a barrier to engagement. Nonetheless, financing needs and approaches remain an underdeveloped component of many countries' adaptation planning efforts.

The third key challenge is to measure and assess whether plans or strategies are reducing countries' vulnerability to climate change. The limited progress in designing and implementing monitoring and evaluation (M&E) frameworks partially reflects the high-level nature of many adaptation strategies, which are not always sufficiently detailed to enable assessments of progress. However, even countries with plans specifying actions, responsibilities and timescales are at an early stage with M&E. However, some promising and replicable approaches are being developed in a small number of OECD countries. Further development of robust M&E will be vital to ensuring political support for government action and therefore support for continued funding, but also to identify what works and what does not, thereby helping adaptation programmes to improve their effectiveness over time.

These key challenges are being faced by all countries involved in national adaptation planning, although they are at different stages in their efforts to overcome them. Sharing the results of what has worked well – and also what has not – will ultimately help to ensure that progress in planning translates into improved outcomes.

1. Introduction

The OECD *Environmental Outlook to 2050* demonstrated that more ambitious policies are urgently needed to reduce global emissions of greenhouse gasses. Without additional measures, global average temperatures are likely to increase by 3 – 6 °C above preindustrial levels by the end of this century (OECD, 2012a). Surpassing the 2 °C threshold would have severe social, economic and ecological implications. Adaptation – alterations in behaviour in response to current or expected change climate change – is an essential complement to efforts to reduce greenhouse gas emissions. Investments in flood defences, opening new shipping routes and changing the mixture of crops planted are just a few of the measures that can help to reduce the negative effects of climate change. In many cases, the benefits arising from these measures should accrue to the individuals or organisations making the changes.

The diversity of potential impacts, wide range of potential adaptation measures and broad alignment of incentives mean that all parts of society and levels of government will have roles to play in preparing for the effects of a changing climate. Self-interest should encourage the management of risks and exploitation of opportunities, but it will not be sufficient given the pace and extent of changes that may occur. In this context, national governments' actions will be crucial. They are significant actors in their own right through their investment decisions, estate management and procurement policies. They can also take action to facilitate adaptation by others, such as by strengthening flood defences, investing in climate science, and providing information and raising awareness. In addition to this, policies implemented for reasons unrelated to climate change, such as insurance regulations, can have a major impact on the ability and incentives of others to adapt. Identifying climate change risks (and opportunities) and identifying where policy changes may be required can therefore make a significant contribution to countries' preparedness for the effects of climate change.

National adaptation planning refers to the development of evidence-based and systematic responses by national governments to the current and future effects of climate change. This paper provides an overview of the national planning activities underway in OECD countries, but also draws out some of the variation in approaches that have been adopted. Countries have made different choices about the degree of central direction, the balance of public and private provision, and the arrangements for financing adaptation. National governments in federal countries and those with strong local autonomy have responded to a different set of opportunities and constraints than in more centralised systems. Given this variety, the aim of this analysis is to draw on the experiences of OECD countries to identify the lessons that can be learnt from the range of approaches that have been taken. It is intended to help inform the development and refinement of adaptation policies within OECD countries, but also to share lessons that may be useful for developing countries as they develop their national adaptation plans.

This paper is organised as follows: Section 2 examines the record so far in implementing adaptation strategies within OECD countries, drawing on the discussion at the *Policy Forum on Adaptation to Climate Change in OECD Countries* in May 2012 and a review of countries' National Communications to the United Nations Framework Convention on Climate Change (UNFCCC) and complementary sources. Section 3 examines specific domestic experiences of implementing adaptation in England, Mexico and the United States, three OECD countries that represent a range of different regional contexts and governance structures for adaptation. The case studies aim to identify commonalities and differences and to examine the extent to which these experiences are transferable to different national contexts. Section 4 builds on the review of OECD-wide progress and the case studies to identify some of the lessons learnt from the design and implementation of adaptation programmes, and their implications for the development of future national adaptation plans.

2. Status of national adaptation policies in OECD countries

At the international level, adaptation has taken its own prominent place alongside mitigation within climate negotiation processes and is likely to be a critical component of any post-2012 international climate regime. Similar signs of progress can be seen at the national level within OECD countries. Since Finland published its national adaptation strategy in 2005, a further 17 OECD countries have published national adaptation strategies, and 8 more are currently developing national strategies.

This section summarises some of the key developments in national approaches to adaptation planning. It, and the rest of the paper, builds on previous analyses of progress, a review of countries' actions as set out in their latest National Communications to the UNFCCC, and the discussion and conclusions from a *Policy Forum on Adaptation to Climate Change in OECD Countries*, held at the OECD in Paris in May 2012.

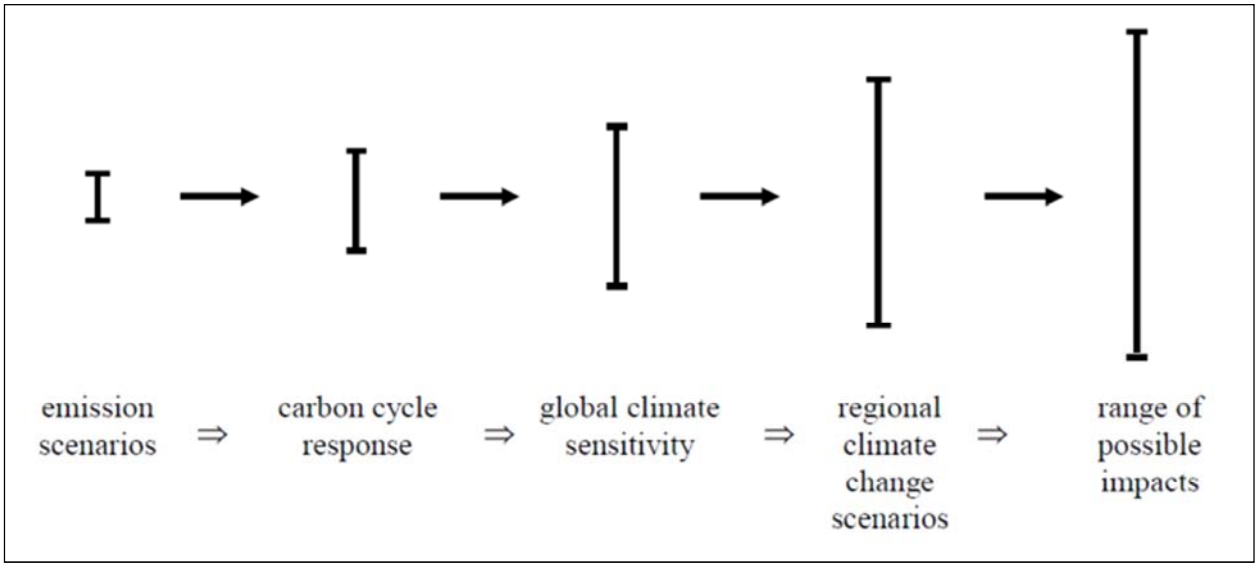
2.1. Overview of previous research

There is now a growing body of research relevant to the development of adaptation policies in OECD countries. Initially, the main focus was providing recommendations of what that planning ought to consist of, and how governments ought to enact adaptation plans. This has included literature making the case for adaptation, as opposed to concentrating solely on mitigation. Research has also sought to establish criteria to guide government adaptation decisions and analysed the appropriate role for governments in the adaptation sphere – for example, when there are market failures that limit adaptation, to respond to uneven distributions of impacts, and to develop societal adaptive capacity (Fankhauser, Smith and Tol, 1999; Cimato and Mullan, 2010).

Some of the key themes of this literature have been the challenges generated by long time horizons involved in adaptation decision making, pervasive uncertainty about the magnitude (and sometimes even direction) of climatic changes, and information deficiencies (Agrawala and Fankhauser, 2008; Hallegatte, Lecocq and de Perthuis, 2011). These have been illustrated in the form of cascading levels of uncertainty, where uncertainty increases at each stage of climate change impact forecasting (see Figure 1), making it difficult to know what impacts to plan for and hence what adaptation measures will be required. A number of recommendations have been proposed to assist decision making in the face of these challenges. These recommendations generally emphasise: building in flexibility, implementing no-regrets and win-win options, and paying attention to distributional issues.

Researchers have also looked specifically at the implementation of adaptation planning at the national level. The OECD (2009) provides guidance for integrating climate change adaptation at the national, sectoral and project levels. Although targeted at developing countries, the underlying principles are applicable more widely. The World Resources Institute (WRI) has elaborated a framework for national adaptive capacity (WRI, 2009). This includes: a system and capacity for conducting assessments of vulnerability, impacts and measures; a process for prioritising adaptation actions; a system for co-ordinating national activities; and climate information management and dissemination systems. The aim of this framework is both to evaluate countries' progress, and also to identify priorities for improvement. This approach has subsequently been tested in three countries: Bolivia, Ireland and Nepal.

Figure 1. Cascading levels of uncertainty in climate change impact forecasting



Source: Schneider, 2003

There is also a small body of work that has intended to compare the implementation of adaptation policies within developed countries. One of the first analyses was Gagnon-Lebrun and Agrawala's (2006) assessment of overall trends, largely based on an analysis of National Communications to the UNFCCC. Their review found that adaptation received limited attention relative to mitigation, and that countries were at the stage of identifying generic options for responding to climate change rather than formulating comprehensive, mainstreamed adaptation strategies. The authors recognised that the survey did not necessarily reflect the latest activity in this area due to time lags between policy development and reporting to the UNFCCC. In addition to that, national adaptation planning is likely to have progressed markedly (at least in the most active countries) over the six years since the paper's publication.

Recent studies have looked in more depth at subsets of OECD countries. These have primarily focused on European countries but some have also included non-European OECD countries – for example, Australia and the United States (Bauer, Feichtinger and Steurer; 2011; Preston, Westaway and Yuen, 2011). Swart *et al.* (2009) provides an in depth review of development processes for European countries' national adaptation programmes, focusing on six areas: motivating factors for strategy development; research and scientific assessment; communication and awareness raising; multilevel governance; integrating climate change adaptation into sectoral policies; and monitoring and review of adaptation policies. The review identified several typical strengths and weaknesses in adaptation strategies – the strengths include targeted research and good planning for implementation, review and funding, while weaknesses included a lack of co-ordination between sectors and unclear allocations of responsibilities between different administrative levels. Preston, Westaway and Yuen (2011) further highlight the institutional and capacity challenges to implementation.

Other reviews have taken a narrower focus on particular aspects of implementing adaptation policies. Bauer, Feichtinger and Steurer (2011) focus particularly on co-ordination and integration in ten OECD countries, both horizontally across policy sectors and vertically across jurisdictional levels. They found that vertical co-ordination is usually addressed earlier in federal political systems than in unitary systems, but that this difference fades as national adaptation strategies are developed. Westerhoff, Keskitalo and Juhola (2011) pay specific attention to the relationships between national-level policies and local-level actions in four European countries. The authors note that national political support and leadership are key factors in

the development of national adaptation activities, but highlighted some of the regional- and city-level activities that developed in the absence of national support. These sub-national activities have been reliant on either sufficiently large internal financial resources, or on the ability to draw on external resources and information – for example, through climate change networks.

A common feature of the comparative literature is the emphasis on description rather than evaluation, which reflects both the relative newness of the field and also the lack of consensus about the most appropriate approaches for implementation. While there is general agreement over many of the broad principles for efficient adaptation, there are a range of views about how those principles should be put into practice. For example, Swart *et al.* (2009) argue that it was not possible to provide policy recommendations at the time of their analysis because of the variation between countries' adaptation priorities, climate impacts and political systems. Measures that have been successful in one context may not translate well to other countries. However, while each country has its own individual policy context, it is nonetheless possible to identify common factors and themes in countries' adaptation programmes.

2.2. Overview of progress to date

This section updates the analysis in Gagnon-Lebrun and Agrawala (2006) to provide an overview of the current status of activities across the OECD. It uses a survey of National Communications to the UNFCCC as the initial source of information on the extent of activity that is underway within OECD member countries.[1]

National Communications have three characteristics that make them a useful as a starting point for this analysis (Gagnon-Lebrun and Agrawala, 2006). The first is that they have comprehensive coverage, with all OECD member countries having submitted at least one report. Twenty nine countries published their fifth National Communications in 2009 or 2010. For the remaining OECD members – Chile, Israel, Korea, Mexico (non-Annex I countries) and Turkey – the analysis is based on their most recent NCs.[2] The second is that the format is standardised, which facilitates comparison between countries. The third is that they are official statements and, as such, should reflect the government's perspectives and priorities.

The approach adopted for this section has been adjusted to address the limitations with using National Communications as a sole data source. As discussed by Gagnon-Lebrun and Agrawala (2006), NCs may not fully reflect the progress to date within OECD countries. Some elements may be missed because the NCs are intended to provide an overview of the main activities underway, rather than an exhaustive account of all the adaptation activities taking place within a country. Additionally, the majority of NCs included in the analysis were published in 2009 or 2010, and due to the pace of change in adaptation programmes they may lack some important recent developments. The review of NCs has, therefore, been complemented by information from national planning documents, direct contact with member governments and the May 2012 *Policy Forum on Adaptation to Climate Change in OECD Countries*. The Policy Forum brought together policy-makers and experts from 25 OECD countries, from international organisations and from the private sector to discuss progress, common challenges and successes in the development of national adaptation strategies (OECD, 2012b).

[1] See Annex 1 for the original table from Gagnon-Lebrun and Agrawala (2006). The original version included additional European countries which are excluded from the updated table, and also did not include four OECD countries (Chile, Israel, Luxembourg and Turkey) which are included in this analysis.

[2] Parties to the UNFCCC are classified as "Annex I" (developed countries and countries in transition to a market economy) or "non-Annex I" (developing countries). Most OECD members are Annex I countries, with the exception of Chile, Israel, Korea, Mexico. NCs from Annex I countries are subject to expert "in-depth reviews", whereas NCs from non-Annex I countries are not subject to an "in-depth review". Turkey is an Annex I country, but has only published one NC.

The review, presented in Table 1 (below), is based on a qualitative analysis of every OECD country's NCs, assessing both the *scope* and the *depth* of coverage of adaptation-related issues within them. The assessment of the scope of discussion is based on the level of attention paid to the topic, classified as: i) extensive, ii) limited, or iii) lacking. The assessment of the depth of coverage is based on the quality of the discussion: i) detailed, ii) generic, iii) limited, or iv) lacking.[3] These assessments were applied to eight components national adaptation planning:

1. Discussion of historical climate trends;
2. Climate change scenarios;
3. Impact assessments;
4. The identification of adaptation options;
5. Discussion of policies that are synergistic with adaptation;
6. Discussion of mechanisms for directing adaptation responses;
7. Formulation of specific adaptation policies or the modification of existing policies to include adaptation;
8. Explicit incorporation of adaptation in projects.[4]

Complementary sources of information were then used to identify both completed and ongoing activities relating to the establishment of institutional mechanisms for adaptation responses and the formulation of adaptation policies that were not identified in the NCs. Where there was no coverage of activities for a specific component within a country's NC, but complementary sources indicated that actions had been taken or are currently underway, these additional activities have been identified in the table using cross-hatching.

This analysis distinguishes between different levels of planning – specifically, between adaptation *strategies* and adaptation *plans*. In this study, adaptation strategies refer to countries' initial planning or framework documents, which commonly set out governmental approaches to adaptation and communicate priorities. Adaptation plans refer to more substantive planning documents which establish specific policies and measures to be taken. This division is reflected in the summary table below, which groups countries into four subcategories – those which have not published an adaptation strategy, those which have not published a strategy but have taken significant national action, those which have published a strategy but not a full adaptation plan, and those which have published both a strategy and a plan. The distinction between strategies and plans is somewhat subjective – countries' adaptation planning documents vary widely in their coverage and concreteness. This analysis only includes national-level documents that target the main climate change impacts (the composition of sectors will depend on specific country contexts). Some countries have published sub-national adaptation strategies or plans concerning specific sectors or geographic regions, which can contribute to preparations for climate change but have not been included in this analysis.

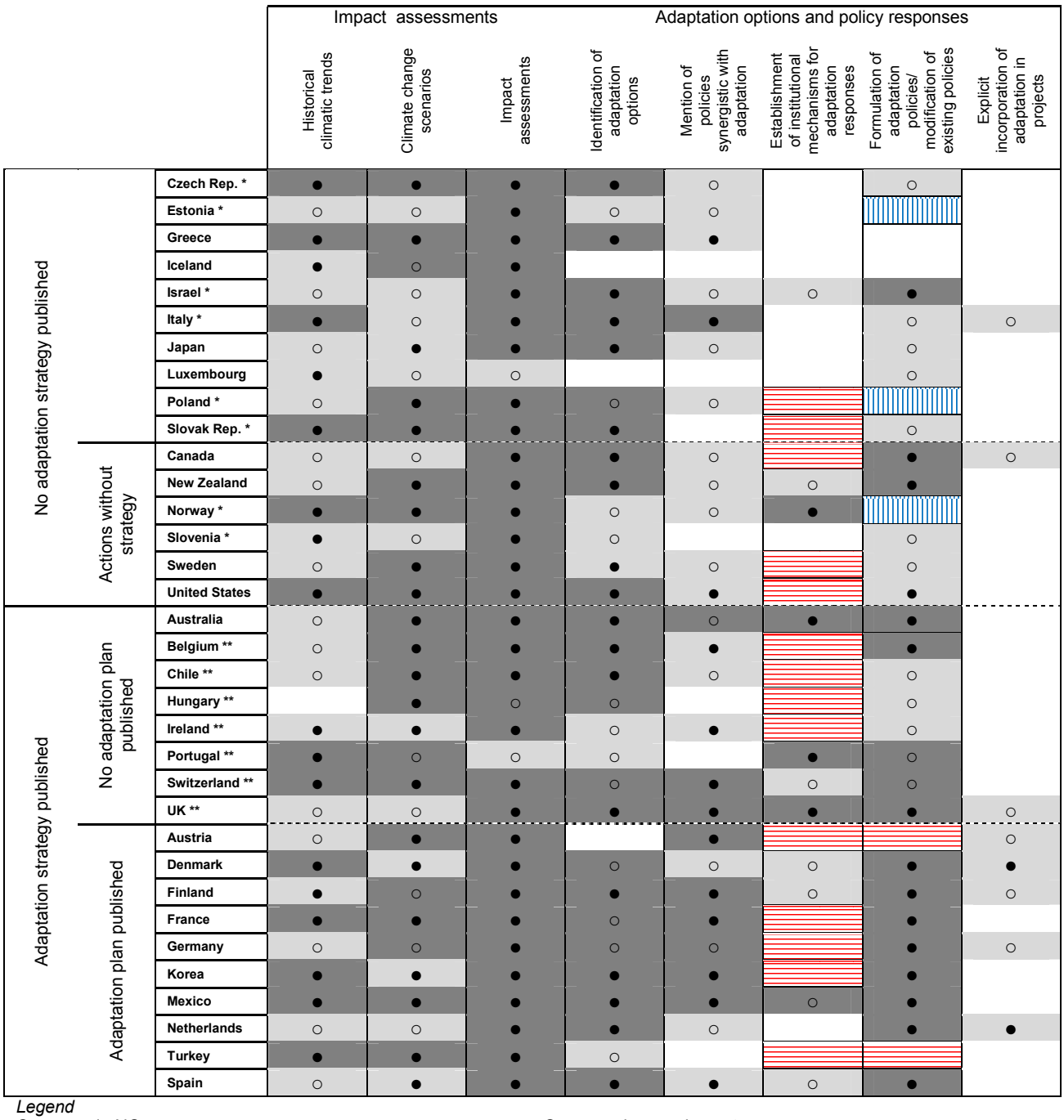
Table 1 shows that all countries cover climate change impacts and future scenarios in their NCs. In addition to this, it shows there is widespread discussion of adaptation options and of policies synergistic with adaptation – 31 countries cover adaptation options in their NCs. This compares to the situation in the previous survey where 16 OECD countries had mentioned this in their NCs. There has also been significant activity in developing adaptation policies – 27 OECD countries mention policies that are

[3] See Annex 1 for more detail on how classifications of *scope* and *depth* were assessed.

[4] See Annex 1 for more detail on what is included under each individual component.

synergistic with adaptation (compared with 13 in 2006) and 27 countries discuss specific adaptation policies or the modification of existing policies to include adaptation (compared with 5 in 2006). The scale of activity in this area becomes even more apparent when additional sources of information are considered. According to this analysis, of the 16 countries which have not yet published an adaptation strategy 8 are currently developing strategies (including 3 who did not identify any adaptation policies in their NCs). Of the 8 countries which have published a strategy but not an adaptation plan, 7 are currently developing a plan.

Table 1. Coverage of adaptation in National Communications



Legend

Coverage in NCs:

	Extensive discussion
	Some mention / limited discussion
	No mention of discussion

Coverage in complementary sources:

	Activities discussed in other sources
	Activities currently underway
*	Currently developing a national adaptation strategy
**	Currently developing a national adaptation plan

Quality of discussion in NCs:

●	Discussed in detail, i.e. for more than one sector or ecosystem, and/or providing examples of policies implemented, and/or based on sectoral/national scenarios.
○	Discussed in generic terms, i.e. based on IPCC or regional assessments, and/or providing limited details/no examples/only examples of planned measures as opposed to measures implemented.

Source: Based on National Communications, supporting publications and complementary information

2.3. Detail on progress to date

Table 1 provides an overview of the level of activity across countries, but countries may be rated as undertaking similar levels of activity while adopting quite different approaches. This section looks in more depth at some of the key aspects of national adaptation planning, focusing on the following four themes:

- *Evidence on impacts, adaptation and climate modelling* – Climate projections are the starting point for understanding more about the climate that countries will face, but this theme also includes a broad range of evidence provision (e.g. decision-making tools, impact assessments) intended to inform decision-makers at different levels.

- *Strategic direction* – Includes setting national priorities for adaptation, ensuring that inter-sectoral issues are addressed, and monitoring progress at the national level. These functions can all be addressed together as part of a national strategy, or they can be dealt with separately.

- *Implementation* – Includes bringing adaptation into government processes such as procurement, budgeting and regulation. This can also include the provision of stand-alone adaptation projects, although in practice these are rare.

- *Multi-level co-ordination* – Local and sub-national authorities are often the tier of government with primary responsibility for addressing climate impacts. Both vertical co-ordination (between national and local governments) and horizontal co-ordination (between local governments) can be used to enable independent, context-specific decision making to occur.

2.3.1. Evidence on impacts, adaptation and climate modelling

The survey of NCs found that all OECD countries include information on climate change scenarios and impact assessments in their reports, generally focusing on impacts and vulnerabilities. Many countries have undertaken comprehensive national assessments to identify their key vulnerabilities to climate change. Although primarily qualitative, some OECD member countries are increasing their use of quantitative information in these assessments, both as a reflection of the potential opened up by having a wider evidence base and also because of demands from policy makers. However, even the most sophisticated studies are only able to quantify a subset of potential impacts (whether in terms of the direct climatic impact, or the knock-on societal and economic effects), and there is considerable variation in the robustness with which it is possible to quantify some impacts (Watkiss and Hunt, 2012).

Compared to the previous areas, there has been much less progress with respect to providing evidence to help select, prioritise and justify adaptation interventions. Coverage is incomplete at the sectoral and local levels, where there are some pockets of analysis but the context-specific nature of adaptation means that it is challenging to transfer them to new circumstances. At the national level, there is limited evidence on the costs and benefits of adaptation interventions, or even on the total scale of impacts in OECD countries (ClimateCost, 2011). Sweden and the Netherlands have produced estimates of some national adaptation costs, but not of the benefits. There is, however, now work underway to help fill this gap. The United Kingdom has commissioned a study, due to be published in 2013, to provide estimates of both costs and benefits of selected adaptation measures. Germany, Austria and Spain have prioritised the collection of more evidence on the economics of adaptation.

2.3.2. Strategic direction (horizontal co-ordination)

The characteristics of climate change adaptation give rise to a need for strategic direction at the national level, above and beyond the work that is underway within individual sectors. Eighteen OECD

countries have produced national adaptation strategies setting out their approaches to adaptation, and an additional eight countries are currently developing or finalising national strategies. The terminology and focus of national strategies differ between countries. They all make reference to projected climate change impacts and vulnerabilities, but vary in their coverage of identifying adaptation options, their discussion of specific adaptation policies and their planning for co-ordinating and delivering national adaptation responses. Commonly, national adaptation strategies aim to communicate the government's overall approach, facilitate co-ordination, demonstrate political commitment and help with the provision of evidence and tools (Swart *et al.*, 2009). Broadly speaking, they focus more on improving the evidence base and building adaptive capacity and enabling environments for adaptation, as opposed to setting out specific adaptation measures. Some national strategies have also identified policies synergistic with adaptation, included the results of a prioritisation process to identify priority adaptation options, and established institutional mechanisms for adaptation responses. Several OECD countries have followed the publication of strategies with the development of more detailed adaptation plans. Table 2 summarises those countries which have published national adaptation strategies and plans, as of December 2012.

Table 2. OECD countries' published reports on adaptation approaches

Adaptation strategy published	Adaptation strategy published, national plan in development	Adaptation strategy published, national plan published
Australia *National Climate Change Adaptation Framework*, 2007	**Belgium** *Belgian National Climate Change Adaptation Strategy*, 2010 **Chile** *National Climate Change Strategy*, 2006 **Hungary** *National Climate Change Strategy*, 2008 **Ireland** *National Climate Change Adaptation Framework*, 2012 **Portugal** *National Strategy for Adaptation to Climate Change*, 2010 **Switzerland** *Adaptation to Climate Change in Switzerland*, 2012 **United Kingdom** *Adapting to climate change in England: A framework for action,* 2008	**Austria** *Austrian strategy for adapting to climate change*, 2012 *Action Plan: Recommendations for implementation*, 2012 **Denmark** *Danish strategy for adaptation to a changing climate*, 2008 *How to manage cloudburst and rain water - Action plan for a climate-proof Denmark*, 2012 **Finland** *National Strategy for Adaptation to Climate Change*, 2005 *Adaptation to Climate Change in the Administrative Sector of the Ministry of the Environment*, 2008 **France** *National Strategy for Adaptation to Climate Change*, 2006 *National Climate Change Adaptation Plan*, 2011 **Germany** *German Strategy for Adaptation to Climate Change*, 2008 *Adaptation Action Plan for the German Strategy for Adaptation to Climate Change*, 2011 **Korea** *National Climate Change Adaptation Master Plan*, 2010 * **Mexico** *National Climate Change Strategy,* 2007 *Special Programme on Climate Change*, 2009 **Netherlands** *National Programme for Spatial Adaptation to Climate Change*, 2007 *Delta Programme,* 2011 **Turkey** *National Climate Change Strategy 2010-2020*, 2010 *National Climate Change Action Plan 2011-2023*, 2011 **Spain** *National Climate Change Adaptation Plan*, 2006 *National Climate Change Adaptation Plan – First Work Programme,* 2006 *National Climate Change Adaptation Plan – Second Work Programme,* 2009

* The Korean National Climate Change Adaptation Master Plan combines elements of both an adaptation strategy and plan.

National adaptation plans typically build on the preliminary activities and evidence gathering of adaptation strategies and outline concrete actions, including formulation of adaptation policies and specific adaptation projects. In some cases, countries may choose to produce a single planning document that combines the elements of adaptation strategies and adaptation plans, as in the case of Korea's *National Climate Change Adaptation Master Plan*. Of the 18 countries that have published adaptation strategies, 10 have published adaptation plans – as defined in this analysis – and 7 more are currently developing plans. For example, France followed the publication of its national adaptation strategy in 2006 with a national adaptation plan in 2011, which contains 230 specific measures and allocates EUR 171 million to implement adaptation actions. The Netherlands has followed a similar approach, although their adaptation plan (the Delta Programme) has particularly emphasised land use planning and flood management. Spain produced an initial work plan for implementing their adaptation framework at the same time as publishing their strategic framework in 2006, and subsequently published a second work programme in 2009. The design of adaptation plans vary depending on countries' approaches and priorities, such as the balance between national and sub-national responsibilities, the balance between public and private responses, and the prioritisation of different sectors.

2.3.3. Implementation

Analysis of NCs indicated that 31 of the 34 OECD countries identified possible adaptation options in their reports, and 27 countries identified existing policies that are synergistic with adaptation. The formulation of specific adaptation policies or the modification of existing policies to incorporate adaptation is discussed in 27 NCs, and the review of complementary materials identified an additional 5 countries that have developed or are in the process of developing such policies. The review of NCs also identified 8 countries that discuss the explicit incorporation of adaptation in specific projects, such as infrastructure investment projects.

The *regulatory* component of implementing adaptation is essential, given that a majority of adaptation actions will be undertaken by private actors (see Box 1 for a fuller discussion of the role of the private sector in implementing adaptation). Examples of major reforms conducive to adaptation include England and Wales' "Make Space for Water" programmes, the Netherlands "Ruimte voor de Rivier" ("Room for the River") scheme and Germany's "Federal Water Act". Aside from water management, other areas with clear examples of regulatory interventions are building codes and infrastructure. Examples of both can be found in the French action plan, which proposes that the aspects of building standards dealing with higher summer temperatures be reinforced. It also proposes that some of the technical standards relating to key pieces of infrastructure be reinforced (e.g. requiring certain levels of capacity to deal with peak demand during the winter; reviewing and adapting the design standards for transport networks).

There is limited coverage within NCs of the *financing* of adaptation measures. Some countries, such as Germany and the United Kingdom, have mainstreamed funding for domestic adaptation measures into their relevant sectoral budgets. Similarly, in the United States, federal-level adaptation measures are funded through relevant agency budget mechanisms. In these countries the additional costs are intended to be allocated through standard budgetary mechanisms. Other countries have "ring-fenced" funding for the implementation of key adaptation actions. Australia allocated AUD 154 million to adaptation over five years, France has allocated EUR 171 million for the implementation of actions in the national plan and Canada has allocated CAD 149 million over five years from 2011 for a mixture of capacity building and the funding of some implementation.

There is also some discussion within NCs of how adaptation has been incorporated into government *operations*. These include aspects such as procurement, the management of public sector assets, and the operation of programmes and services. In the United States, for example, all government agencies are required by a Presidential Executive Order to assess the risks to their operations from climate change, and

to identify and prioritise appropriate measures to respond to those risks. In countries that do not yet have formal requirements for mainstreaming, there has nonetheless been activity to produce non-binding guidance documents. Japan published their *Approaches to Climate Change Adaptation* guidance document in 2010, which is intended to help policy-makers design and evaluate adaptation responses to climate risks (Committee on Approaches to Climate Change Adaptation, 2010).

Across all three implementation areas, countries' planning documents vary in terms of how specific they are with respect to implementing actions. However, regardless of the depth of detail on implementation, very few have specified the process for evaluating strategies or plans and none have yet specified the details of how success will be measured.

Box 1. Engaging the private sector in adaptation to climate change

In theory, the private sector's profit motive provides it with incentives to implement cost-effective adaptation measures. However, there are multiple barriers to action that can inhibit adaptation and lead to maladaptive behaviour, including uncertainty, imperfect information and market and regulatory failures. (See Agrawala *et al.*, 2011 and UNGC *et al.*, 2011 for more detail on barriers to action.) Recent OECD empirical analysis of companies' management of their climate risks suggests that self-interest alone has not been sufficient to overcome barriers to adaptation (Agrawala *et al.*, 2011). A review of companies' climate risk disclosures indicated that while three quarters of surveyed companies acknowledged climate risks to their business, only one in four assessed the extent of their risks or possible risk management options, and only one in twenty implemented risk management actions.

This lack of action is a particular concern in the case of economically significant sectors, those that are climate-sensitive, and those where investment decisions have long-term implications. For these reasons, the provision and management of infrastructure plays a major role in countries' national adaptation planning, both in terms of the need for additional investment for addressing climate risks and the need to climate-proof existing infrastructure and ongoing investments.

Many OECD countries include measures for engaging with the private sector in their national adaptation strategies and national planning documents, although the depth of discussion varies significantly across countries. A common focus of this planning has been to enable private adaptation responses by helping the private sector overcome key barriers to action. As an initial step, countries have often focused on providing information and raising awareness. However, while this can help to motivate action, analyses of companies' experiences suggest that it is unlikely to be sufficient in isolation. OECD governments have included a range of other measures to encourage and enable private sector adaptation in national plans, including:

- *Providing tools and guidance.* These go beyond general information provision, and provide high-quality, accessible climate data, guidance on managing climate issues, and tools to assessing climate risks and planning adaptation responses.
- *Maintaining regulatory coherence.* Governments have emphasised the need to ensure that regulatory frameworks are conducive to risk management, including managing overlapping and conflicting regulatory regimes. For example, governments have updated design codes so that new developments are resilient to projected climate change impacts.
- *Establishing reporting requirements*. This is a less common approach, but has been used to ensure that companies in key areas, such as providers of critical national infrastructure, regularly assess and report on their exposure to climate risks. Notable examples include the United Kingdom Adaptation Reporting Power and the inclusion of climate change in regulatory disclosures to the United States Securities Exchange Commission.
- *Using procurement policies.* Governments have recognised their powers as procurers to encourage and require private sector suppliers to take account of climate risks.

2.3.4. Multi-level co-ordination

Many NCs identify actions that are taking place at the local or regional level, with federal countries tending to devote more attention to sub-national action than unitary (non-federal) countries. In some cases,

the sub-national level has been the primary focus of discussions of adaptation actions within the NCs. For example, the United States' NC5 outlines California's adaptation research and planning at the California Climate Change Research Center and New York City's planning for climate impacts on the municipal water system. Similarly, France's NC5 discusses Paris' planning to mitigate the impact of heat waves in the city. Beyond the discussion of specific examples of local or state adaptation actions, there tends to be limited systematic discussion of how national governments are helping to overcome barriers to adaptation at the local level.

Within OECD countries, the overall systems of governance have influenced the scope and characteristics of national planning for adaptation. France's comparatively centralised political system has been reflected in its comprehensive national adaptation plan. The national government has control over many of the key policy levers, and as such this is the level where adaptation has been implemented. The United Kingdom government's adaptation planning only covers policies in England and "reserved matters" (those that are not the responsibility of the devolved governments). Adaptation policies in Scotland, Wales and Northern Ireland are under the responsibility of their national administrations. Norway is also a unitary state, but its strong tradition of localism means that its national approach places a strong emphasis on actions to facilitate adaptation by municipalities, which are largely responsible for implementation.

All of the federal OECD member countries have undertaken national-level adaptation efforts. Six of the countries have produced adaptation strategies or plans, while the United States and Canada have yet to do so. Canada's *Federal Adaptation Policy Framework* establishes the federal government's role as: generating and sharing knowledge, building adaptive capacity, and mainstreaming adaptation into federal policies and operations (Government of Canada, 2011). In the United States, a recent initiative at the federal level has focused on mainstreaming adaptation within the federal government's operations, while recognising the significant role of the state, tribal and local governments in planning for and implementing adaptation at sub-national levels. Austria's national adaptation strategy places primary responsibility for adaptation at the federal level. Australia's commonwealth (national) government sees its role as 'positioning Australia to adapt to climate change impacts that may affect national prosperity or security' (Australian Government, 2010). This consists of adapting the national government's own operations and driving and co-ordinating action by state and territory governments. Mexico, Belgium, Germany and Switzerland's strategies envisage a broad degree of involvement from the national government across sectors.

Countries' also highlight their contributions to international adaptation efforts in their NCs. These efforts are particularly relevant for the member countries of the European Union (EU), as many of the sectors affected by climate change are affected by EU regulations and policies. The European Commission's 2009 white paper on adaptation sets out a proposed approach for implementing adaptation in key sectors at the European level and explores the joint role of European institutions and member nations (European Commission, 2009). One of its proposals is to require EU members to produce national adaptation strategies. The EU is also beginning to mainstream adaptation in its sectoral policies, including agriculture and forestry, coastal areas, fisheries and the marine environment, infrastructure, finance, water management, biodiversity, disaster risk reduction, and health.[5] Given these activities, it is possible that the overview of activities reported by European countries understates the total level of actions across the EU.

[5] The international activities at the EU level provide an interesting parallel to national-level activities in federal states. Federal governments and the European Commission can be seen to have analogous roles in enabling action at lower levels of government while at the same time mainstreaming adaptation into their own operations.

3. National experiences in implementing adaptation: Case studies

Building on the overview of progress across the OECD, three country case studies provide a more detailed look at the approaches adopted by member countries. These case studies summarise: the history and structure of adaptation planning; the elements that have appeared to be successful so far; the key challenges that have been faced; and the extent to which the approach may be transferable more widely.

The three countries selected – England, Mexico and the United States – represent a range of different regional contexts and governance structures for adaptation. The United Kingdom is frequently cited as being one of the more advanced countries in terms of implementing adaptation and is a unitary state, albeit one where much adaptation policy-making is devolved to national administrations. The case study focuses on the programme in England. The United States has taken an approach to adaptation that has a stronger role for state and local action, reflecting in part its federal system of government and also its much greater degree of climatic diversity. Mexico, meanwhile, has recently initiated a systematic process to address adaptation and differs from the other case studies in being an upper-middle-income economy. The case studies were produced with significant input from national policy experts and practitioners. They are informed by these national actors' own views on the successful elements of their national programmes and on the challenges they have faced.

These three countries' varying experiences offer critical insights into designing and implementing national adaptation programmes, including where the three countries have taken similar approaches, where they have faced unique challenges, and where they have responded differently to similar challenges. Their experiences complement the analysis of OECD-wide progress in adaptation, and help to identify both where and why different approaches to adaptation are successful.

3.1. England

The United Kingdom government published an adaptation policy framework in 2008 to co-ordinate and promote action on adaptation in England.[6] This framework includes developing the evidence base, mainstreaming adaptation in government activities, and working with partners to enable their own adaptation responses (Defra, 2008). The ultimate goal of the framework is the creation of a National Adaptation Programme (NAP) for England, to be finalised in 2013. This approach has already achieved some major successes, in addition to illustrating some of the challenges with designing and implementing a national adaptation plan.

The creation of this framework, and the programme of activities to support its implementation, occurred within the context of strong political support for the climate change agenda – both adaptation and mitigation. Work on adaptation has been funded by the government since the 1990s, starting with initial research into climate impacts and followed by the establishment of the United Kingdom Climate Impacts Programme (UKCIP) in 1997, a "boundary organisation" intended to create stronger links between the research and policy-making communities (West and Gawith, 2005). With the support of UKCIP and others, climate change has been integrated into some areas of government policy, notably flood management. The decision to establish a programme in 2008 was driven by recognition within government of the need to scale-up and co-ordinate the government's activities on adaptation. This was complemented by external pressure from non-governmental organisations (NGOs), businesses and the wider public sector for the government to take a leading role on adaptation. The timing was driven by the passage of the

[6] The United Kingdom government's adaptation programme covers England and some United Kingdom-wide policy issues (e.g. defence, trade, foreign policy). The Devolved Administrations in Scotland, Wales and Northern Ireland have their own policy frameworks for adaptation, which are broadly similar to the United Kingdom government's approach for England.

legislative framework for the government's adaptation and mitigation policies, the Climate Change Act 2008 (Great Britain, 2008).

England has already observed changes to its climate. Since the 1970s the temperature in central England has risen by around 1 ºC and the surface sea temperature has risen by 0.7 ºC (Defra, 2009). Based on a central estimate for future emissions (with emissions peaking around 2050 and decreasing towards the end to the century), by the 2080s the UKCP09 climate projections forecast summer temperatures across England to increase by between 3 ºC and 4 ºC, with higher increases on the central south coast. They also project decreases in summer precipitation of around 20% and increases in winter precipitation of around 15% to 20%, and forecast sea levels in London to rise by 36 cm. These changes in average climate are projected to lead to increases in the frequency and severity of extreme weather events (including droughts, heatwaves and heavy rainfall), increased risks of flooding, and a significant increase in the likelihood of extremely wet winters (ASC, 2010). While England's geography and climate are not as diverse as in some other OECD countries, regional variations in future climate are still expected – for example, it is projected that the south east and London will be particularly vulnerable to water scarcity – and some areas could actually benefit from climatic changes (e.g. due to knock-on effects on agricultural diversification and increased tourism) (ASC, 2010). Climatic impacts, combined with current land use and social practices, could also create significant societal risks in England. For example, agricultural land is projected to become more prone to flooding, hotter summers and urban overheating are projected to increase heat-related illness and death risks, and flood risks to businesses and key infrastructure are projected to increase (CCRA, 2012).

As a result of its prolonged government interest in adaptation, the United Kingdom is one of the more advanced OECD countries in terms of climate research and progress in designing and implementing adaptation policies. This review of England's national programme can therefore draw on a significant body of research and policy making. Additionally, England's relatively centralised governance system provides a different context to many other OECD countries (especially those with federal or strongly regional systems). The following sections discuss England's specific approach to adaptation planning, the programme's successes, and challenges for policy design and implementation.

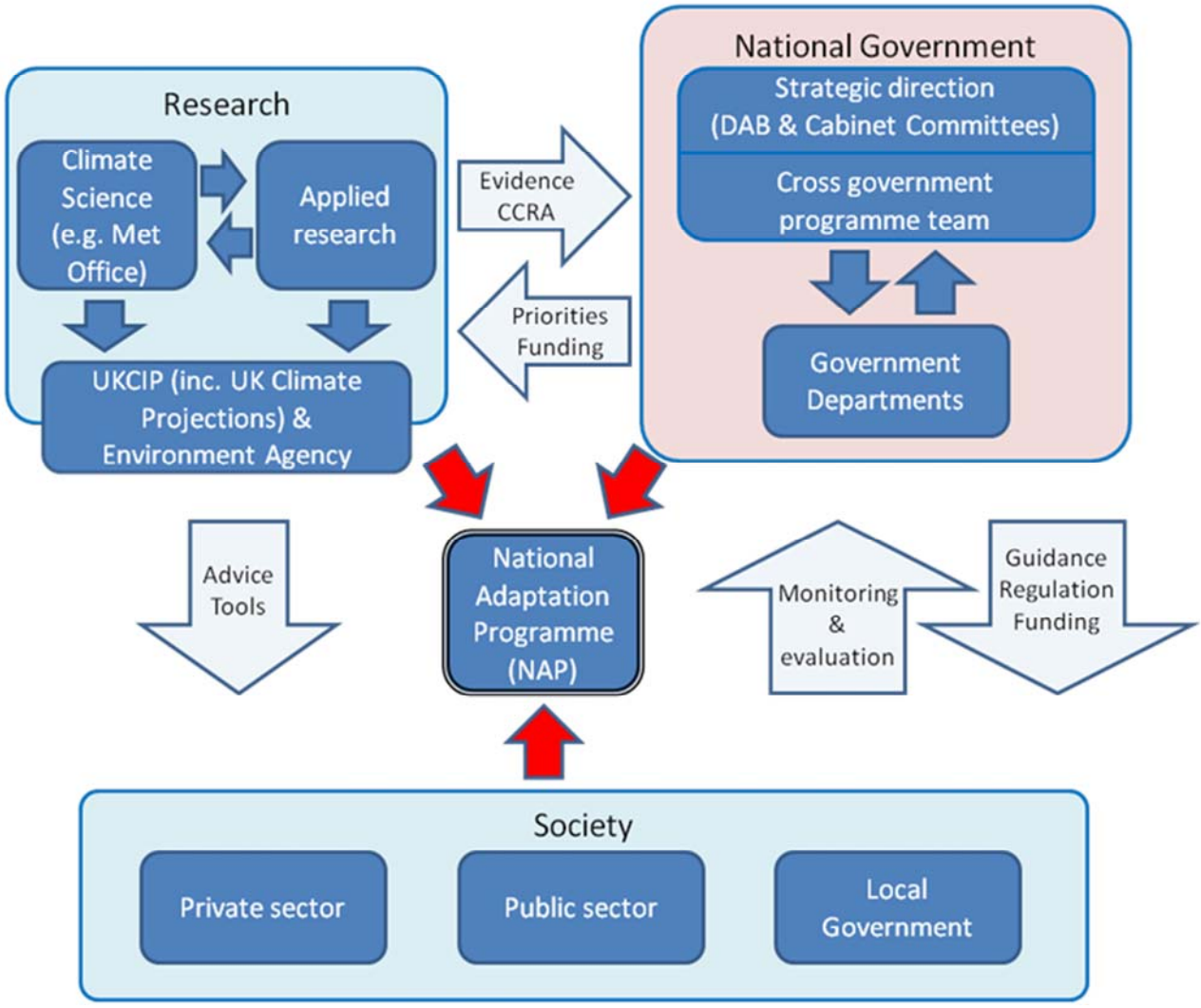
3.1.1. Adaptation programme in England

The programme's underlying approach is that the government should support, rather than supplant, action on adaptation by local authorities, businesses and civil society (Cimato and Mullan, 2010). The government can help organisations and individuals to manage their own risks from climate change, and to take advantage of any opportunities. In addition, it needs to ensure that its own action and policies are well adapted to climate change. This is reflected in the design of the programme: the emphasis on mainstreaming has been complemented with the establishment of a central team to develop the evidence base, help others to take action, ensure progress and embed adaptation throughout government. The adaptation team consists of 35 people with a budget of approximately GBP 10 million per year, the majority of which is allocated for development of the adaptation evidence base. This builds upon the wider work on adaptation funded through national research councils, businesses and NGOs. Funding for adaptation actions, such as building flood defences, is allocated through usual budgetary mechanisms, rather than being specifically allocated to adaptation.

The governance arrangements for England's adaptation programme are intended to be inclusive. A Domestic Adaptation Board (DAB), consisting of senior officials from across the government, oversees the programme and ensures co-ordination between departments. Ministerial decisions on adaptation are co-ordinated through pre-existing cabinet committees. External consultation was initially conducted through a Partnership board, consisting of senior representatives from businesses and other key stakeholders. As the programme has moved towards the development and finalisation of the NAP, stakeholders are now

engaged around the theme areas of the Plan. This collaborative approach has engaged businesses, local authorities, civil society and other key stakeholders in order to directly 'co-create' approaches and policies to be described in the NAP. The structure of England's adaptation programme, including national government co-ordination, climate change research, and all parties' contributions to the development of the NAP, is illustrated in Figure 2.

Figure 2. Overview of England's adaptation programme



Note: CCRA = Climate Change Risk Assessment

The 2008 policy framework for adaptation sets out four strands to England's immediate adaptation efforts. The overall aims of this have been to drive action now, and to lay the foundations for the statutory National Adaptation Programme in 2013. These four strands and the NAP are described in more detail below.

Developing the evidence base on adaptation

The first strand focuses on developing the evidence base on adaptation. The centrepiece is the UKCP09 climate projections, which provide projections of how the United Kingdom's climate will change over the course of this century. These are the latest in a series of climate projections for the United

Kingdom, the first of which was produced in 1991. The overall message of warmer wetter winters and hotter drier summers has stayed constant through each revision. However, the latest version is at the frontier of climate science: it provides projections at a scale of 25 km^2 and provides likelihood distributions for each climate outcome. This makes it possible to consider high impact but low probability changes, allowing for more informed risk management and planning than was possible with the point estimates provided in previous iterations.

The projections have been complemented by the Climate Change Risk Assessment (CCRA), published in January 2012 and to be updated every five years. The risk assessment outlines key risks and opportunities arising due to climate change. The CCRA has assessed over 100 different risks across eleven sectors: Agriculture; Biodiversity and Ecosystem Services; Built Environment; Business, Industry and Services; Energy; Floods and Coastal Erosion; Forestry; Health; Marine and Fisheries; Transport; and Water (Defra, 2012a). The CCRA's approach provides an indication of the level of risks posed by climate change by considering both the scale of impacts and the likelihood of different impacts occurring. The most significant risks highlighted by the CCRA include increases in extreme weather (both flooding and heat waves), increasing stresses on water resources, and growing pressure on ecosystems and biodiversity (CCRA, 2012). The CCRA provides evidence to support and inform adaptation measures and policy making, both geographically and by sector, while also placing the risks from climate change in context of other social and economic pressures on society and noting the areas where more analysis is needed to understand climate change risks. The CCRA's findings have highlighted several areas with the greatest need for action in the immediate future: (i) flood and coastal erosion risk management; (ii) managing natural ecosystems; (iii) managing water resources; (iv) addressing building overheating in urban areas; (v) managing risks to health and impacts on public health systems; (vi) seizing economic opportunities arising due to climate change (CCRA, 2012).

Building on the CCRA, an Economics of Climate Resilience project has been initiated to support the economic case for action on adaptation. Using the results of the CCRA's analysis, it will help to prioritise adaptation actions and identify the scale of costs and benefits of responding to the risks identified by the CCRA. This project aims to provide a robust economic evidence base to support the development of the NAP, will assess the case for action, and provide detailed analysis of select policy options.

In addition to these government-funded activities, England's adaptation programme also works to shape the research agenda of other organisations. In particular, the government uses its influence with the funders of academic research to encourage investigation of relevant adaptation issues. This gives the programme leverage over significant research capacity – for example, national research councils are spending GBP 1 billion (over five years) for research into living with environmental change[7]. The adaptation programme has also worked with industry bodies to encourage and advise on research into climate impacts: for example, a study by the Association of British Insurers into the financial consequences of climate change on their industry (ABI, 2009).

Working in partnership

The second strand of the programme aims to ensure that decision makers are aware of the potential impacts of climate change, and that they have the capacity to use that information. The main components of this work strand are to:

[7] See the *Living with Environment Change* programme's website for additional details - www.lwec.org.uk.

- Work with a range of organisations to raise awareness of the issues;
- Promote the information and tools needed to take action;
- Build the capacity within organisations to use the information available to take action.

The government has the power to direct public sector bodies and private sector companies with responsibility for national infrastructure (such as water and energy utilities) to report on their exposure to the risks of climate change through the Adaptation Reporting Power. Alongside their reports, these bodies have to submit proposals for addressing those vulnerabilities. The primary benefit of the Reporting Power is that it ensures that organisations with responsibility for key areas of national infrastructure are aware of their climate vulnerabilities and are conducting thorough risk assessments. The Reporting Power also provides the government with an overview of key sectors' main vulnerabilities and progress in adapting to climate change risks. The first reporting round (conducted between 2009 and 2011) covered 103 organisations, primarily from the energy, water and transport sectors. A review of these reports found that different sectors, and different organisations within the sectors, have made varying levels of progress in adapting to climate change (Defra, 2012b). However, the overall picture from the reports is that these organisations are assessing their risks from climate change and are in a good position to address them. The review of organisations' reports also noted that the Reporting Power has been a catalyst for action in many organisations and has led to greater corporate awareness of adaptation needs.

A diverse range of bodies have been involved in delivering the outcomes for this strand of work, including specialised organisations such as UKCIP. UKCIP is an independent body that works with organisations across the public, private and voluntary sectors to help them build their capacity to adapt. In October 2011 the Environment Agency took over UKCIP's role as the government's delivery body for climate change adaptation in England until 2015. The Environment Agency will build on UKCIP's activities and provide support to help key sectors build resilience to climate change (Environment Agency, 2012). At the sub-national level, the adaptation programme provides funding to Regional Climate Change Partnerships. These Partnerships were established to bring together the key stakeholders at a local level to raise awareness, provide evidence on regional impacts, and co-ordinate the responses of key decision-makers. Following the Environment Agency's new role, the Partnerships have developed a 'partnership agreement' to enable the Environment Agency to build on the Partnerships' achievements and to ensure that local actors are supported in their adaptation decision making (Climate UK and Environment Agency, 2011).

Integrating adaptation into routine practices

The third strand of the programme aims to ensure that adaptation is considered as part of the routine practice of government policy making, spending and investment decisions. The systems and processes that guide these decisions affect the extent to which the public sector adapts well, but also affect the incentives and ability of others to adapt. The programme has examined existing systems to ensure they are fit for purpose, and helped to devise additional guidance where appropriate.

One of the elements of the mainstreaming approach is the supplementary "Green Book" guidance on adaptation. The "Green Book" outlines the approach to cost-benefit analysis that must be used for all central government appraisals of projects, programmes and policies. It sets the framework under which all funding bids are assessed. In collaboration with HM Treasury (the United Kingdom finance ministry), the adaptation programme produced additional guidance to help policy-makers and analysts incorporate adaptation within this framework (HM Treasury and Defra, 2009). Similar work has been undertaken with the United Kingdom Office of Government Commerce to ensure that the government's procurement guidance also takes full account of climate change impacts (Defra and OGC, 2010).

Monitoring and ensuring progress

The final strand of the programme aims to monitor and ensure progress on adaptation. Monitoring progress is an inherently complicated task, because some of the most important outcomes (e.g. reducing deaths in heat waves and floods in the 2040s) will not be measurable for decades to come. For this reason, the emphasis has been on measuring preparedness and the extent to which the right processes are in place.

The 2008 Climate Change Act created a framework for independent scrutiny of the government's adaptation programme, including the creation of an independent expert body to assess progress. The Adaptation Sub-Committee (ASC) of the Committee on Climate Change has a formal role of advising Parliament on adaptation, on the CCRA's progress, and on implementing the NAP. As part of its remit to advise on progress in adaptation, the ASC has developed a monitoring and evaluation framework. Their approach uses a "preparedness ladder" that draws on national adaptation plans that outline how departments are responding to climate change risks to their policies, programmes and properties. The preparedness ladder is structured around three elements: i) monitoring the final outcomes of adaptation activities (in terms of changes in vulnerability); ii) tracking the delivery of outcomes (in terms of increasing adaptive capacity, the incorporation of adaptation into decision making and the timely implementation of adaptation measures); and iii) evaluating whether policy frameworks incentivise action and remove barriers to adaptation (ASC, 2010).

Annual assessments will examine if England is becoming more or less vulnerable to climate risks, whether there has been sufficient uptake of low-regret adaptation actions, and if long-term decisions systematically account for climate risks (ASC, 2010). These assessments are guided by a set of indicators on climate impacts, vulnerability and action. The baselines and targets for these indicators will be determined by the CCRA (Defra, 2012c). Additionally, the CCRA will be repeated every five years, providing regular snapshots of domestic climate risks. The assessments will illustrate if the country as a whole is moving in the right direction, rather than explicitly assess the effectiveness of the government's adaptation programme.

Moving towards the National Adaptation Programme

The four strands of England's adaptation activities, the CCRA and the work of the ASC all build towards the publication of England's first NAP in 2013. The NAP will focus on five core themes: i) Agriculture and forestry; ii) Built environment and infrastructure; iii) Business and services; iv) Health and wellbeing; and v) Natural environment (Defra, 2012d). The Programme will additionally cover a number of cross-cutting areas which thread throughout the NAP.[8]

In line with the underlying approach of England's adaptation programme, the NAP intends to build on previous and ongoing work within government departments, but equally to focus on raising awareness and encouraging action by businesses, local authorities and civil society. In order to capture the views and needs of these groups, the government is working collaboratively with key stakeholders to "co-create" the NAP.

3.1.2. Successes to date

When the programme was established in 2008, it had a strong foundation in terms of climate science and the applied work funded through UKCIP. However, the initial evidence base was patchy, and action

[8] The cross-cutting issues being addressed in the NAP are: i) Impacts on United Kingdom of global climate change; ii) Local Government; iii) Vulnerable groups; iv) Investors and insurers; v) Flooding; vi) Water; vii) Overheating; viii) Green infrastructure; ix) Marine; x) EU policy; xi) Urban; and xii) Mitigation.

and awareness were confined to specific areas. Since then, the programme has had successes at improving the evidence base, raising awareness of adaptation, driving forward action by government and focusing on some of the key evidence gaps. Even the areas where the programme has had less traction have provided useful input into the design of the NAP.

Improving the evidence base and raising awareness

England's adaptation programme has devoted significant resources and attention to climate change science and developing the evidence base for adaptation. The 2009 Climate Projections (UKCP09) provide high resolution data on projected climate change impacts. These impacts, along with significant stakeholder and expert input, have fed into the CCRA's analysis of climate risks and vulnerabilities. The CCRA provides policy-makers with a comprehensible and systematic overview of the likely effects of climate change, and is a useful tool for raising awareness in central and local government bodies (Defra, 2012b).

Reflecting the focus on encouraging and enabling local action, the national programme has developed a wide range of tools and schemes for raising awareness among local government, private sector and civil society actors. The centrepiece of these efforts has been UKCIP, which was created to bridge the gap between climate science, policy makers and the private sector. Over the 15 years since UKCIP was established, the programme has conducted wide-ranging stakeholder-led research to develop climate information and decision-making tools which are relevant and accessible to decision-makers (West and Gawith, 2005). These tools, which are all freely available, include: the "Adaptation Wizard", the "AdaptME toolkit", the "Risk framework"; and a range of projected future "Socio-economic scenarios".[9] The UKCIP programme has encouraged actors across a range of sectors to consider their vulnerabilities and to prepare for climate change, and is viewed by many policy makers as a model for climate change "boundary organisations" (Swart *et al.*, 2009).

England's national programme has additionally included specific efforts to increase awareness and engagement among private sector companies, including assessments of existing climate risk awareness, assessments of business-specific climate change risks and opportunities, and an interactive online "Climate Resilience Toolkit" intended to prepare businesses for climate change.[10] Additionally, the Adaptation Reporting Power has been a strong driver of awareness and interest among reporting organisations (Defra, 2012b).

Co-ordination across government

The programme has aimed to integrate adaptation into existing processes where possible, specifically within appraisal and procurement processes. The "Green Book" supplementary guidance targeted appraisal, and the adaptation programme worked with the central government procurement agency to include adaptation in their guidance documents.

This mainstreaming has been complemented with the requirement for all government departments to produce Departmental Adaptation Plans (DAPs). In each department, a senior official (Director-General or Director) is responsible for identifying the main risks from climate change to their policies, programmes and estates. In March 2010, 16 government departments published DAPs – the reports identified departmental policies and priorities in relation to adapting to climate change, and described the work being done to build capacity and understanding of climate change and to assess climate change risks to departmental assets and estates (HM Government, 2010). Updates on the implementation of the DAPs

[9] See UKCIP (2011) for a review of UKCIP tools, their uptake and lessons learnt from their deployment.

[10] The Toolkit is available at www.businesslink.gov.uk/bdotg/action/layer?topicId=1087319936.

were published in May 2011, including reporting on the progress departments have made since publishing their Plans and on their future adaptation priorities.[11] The depth of analysis in DAPs, the focus on practical actions being taken to manage risks, and the continued reporting on adaptation all indicate significant cross-government commitment to adaptation. The DAPs also give a clear signal to businesses and other key stakeholders that the government is taking adaptation seriously, and help to communicate the government's priorities and actions in responding to climate change across all policy areas.

Integration into delivery of key policies

In addition to the success at influencing central processes within government, the programme has also influenced key areas that will be essential for England's success in adaptation. For example:

- The programme for managing London's flood risk used the same techniques recommended in the "Green Book" and was based on the latest climate projections (UKCP09);
- Exposure to climate risks is now one of the factors considered in making planning decisions;
- Price regulation for the water industry has been amended to account for the investment required as a result of climate change.

Engagement with local authorities

Due to the need for local risks and impacts to be managed locally, the programme has provided support, guidance and learning networks to local authorities to help them assess and respond to risks. Key elements of successfully delivering the right support to the right people have been:

- Establishing mechanisms for co-ordinating local adaptation, for connecting local and central government policy processes, and for building local capacity.
- Developing a framework within which local authorities can identify their own adaptation paths and measure progress.

Between 2008 and 2011 the Local and Regional Adaptation Partnership Board fed local views and needs into government policy development and delivery processes, worked collaboratively to identify and share best practice, built strong communication networks, and provided on-the-ground support to local actors (Defra, 2011). The nine Regional Climate Change Partnerships have also provided tools, support and advice on climate change impacts to local actors, and have supported a range of local projects to increase climate resilience. In 2011 a Local Adaptation Advisory Panel was established to enable regular and direct dialogue between local and central government, to help shape the development of adaptation planning and to direct local government contributions to the NAP (Defra, 2011). Support for local authorities has included the document *Adapting to climate change: A guide for local councils*, which provides guidance on putting together a local adaptation plan, advice on the various tools and support available, an overview of the powers local bodies can use to implement adaptation, and examples of good practices (Defra, 2010). The Local Government Association has also produced a compendium of powers that local government bodies can use to address climate change (both adaptation and mitigation) (LGA, 2008).

[11] The original 2010 DAPs and 2011 updates are available on the Defra website – see www.defra.gov.uk/environment/climate/government/departmental-adaptation-plans.

3.1.3. Challenges

There has been significant progress in England's adaptation planning and the development of the NAP since the 2008 Climate Change Act. However, England's experiences have illustrated some of the challenges that occur in designing and implementing national adaptation programmes. The first of these challenges is inherent to adaptation policy, while the others relate to institutional and organisational factors, and demonstrate the need for further development of adaptive capacity.

Characteristics of climate change

The risks from climate change are subject to uncertainty, are long term, and cut across existing departmental and public sector responsibilities. All of these characteristics have made it challenging to embed adaptation across government. The latest climate projections extend to 2100, but policy planning horizons tend to focus on much shorter timescales. This means that decision makers' incentives to adapt can be weakened, particularly when faced with more immediate pressures. As with other cross-cutting policy areas, it is a continuing challenge to align actions across central and local government.

The pervasive nature of climate change impacts means that the success of the adaptation programme ultimately depends on the co-operation of a wide number of people working in a number of different organisations. The programme relies upon indirect forms of leverage to change these actors' incentives. For example, public infrastructure in England is provided and regulated under a variety of contractual and institutional arrangements. Public bodies and private sector firms responsible for infrastructure can be directed to report on their preparations for climate change, but they have flexibility to choose what adaptive actions are implemented in response. To date, the experience has been of uneven engagement both within the public and private sectors. There is still more work to be done to ensure that the various institutional arrangements in place are all conducive to adapting well.

Resources and capacity

The United Kingdom National Audit Office's review of government departments' preparedness for the effects of climate change found that a lack of resources and capacity were one of the main barriers to action on adaptation within government (NAO, 2009). The current pressures on public finances mean make it difficult to secure additional resources, and have re-emphasised the need to demonstrate that action on adaptation provides good value for money. Against this background, the adaptation programme is working across government to make the most efficient use of the available resources, and make the case for action on adaptation in addition to delivering shorter-term priorities.

There is also a need to develop the technical capacity to design and implement adaptation actions. The UKCP09 climate projections provide a wealth of information, but need a certain level of expertise to interpret correctly and to use that information to design the most appropriate adaptation responses. For this reason, increasing capacity has been a central focus for the adaptation programme, initially delivered by the UKCIP and now taken over by the Environment Agency. There is also a targeted programme of engagement with professional and trade organisations to overcome skills shortages.

Lack of information and evidence

Related to the uncertainty and complexity around climate change, there is a need for more evidence to underpin the economic case for action on adaptation. Cost-benefit analysis is widely used in the public sector to allocate resources and inform prioritisation. In many cases, the immediate additional costs of taking adaptive actions are easier to identify then the value of the long-term benefits. Currently, the evidence on benefits is both patchy and qualitative. This has two consequences: it becomes harder to make the case for organisations to take action, and it makes it more difficult to achieve the correct adaptation

responses. The identification of key risks by the CCRA and the Economics of Climate Resilience analysis should help to make the case for adaptation at a high level. There will, however, be a continuing need for more detailed information on the costs and benefits of individual measures.

The CCRA will provide five-yearly snapshots of vulnerability, and there has been significant progress in developing a framework for monitoring the performance of the adaptation programme. However, there remains more to be done to measure the programme's performance. Work is currently underway to develop a suite of indicators for the programme, which aims to address two underlying challenges. The first of these is that the cross-cutting nature of adaptation policy makes it necessary to examine progress in a wide range of areas. The second challenge is the difficulty in directly linking these indicators to the achievement of the overall objective: helping England to adapt well to the impacts of climate change. Over time, repeating the CCRA process should provide information on changes in vulnerability, while the ASC's approach should help policy-makers make the connection between progress at the planning and process levels and progress in measurable outcomes.

Transferability

The United Kingdom benefits from having a well-developed evidence base on the current climate and projected effects of climate change. The most recent United Kingdom Climate Projections drew heavily upon this infrastructure, and as a result were able to provide a higher level of sophistication than would otherwise be possible. However, this does not directly affect the transferability of this approach to other countries, as the emphasis is on getting the right processes in place, along with flexibility about the set of actions that are implemented. This basic approach is applicable even where climate data is scarce or uncertain.

The nature of projected climate impacts has also led to a focus on implementing "win-win" and "no regrets" policies and measures in this phase of the programme. Once these opportunities have been exploited, and the evidence base has improved, there may be a need to consider measures that impose more significant upfront costs. Countries where more urgent and radical action is needed can still use the overall framework but may need to be more interventionist to ensure that sufficient adaptation measures are taking place. In particular, there may need to be stronger incentives available to encourage adaptation actions across the public and private sectors.

England's market-based approach to the provision of infrastructure and public services has affected the design of the programme. In addition to embedding adaptation within government departments, it has also been necessary to target regulators, delivery bodies and private sector firms. This will vary by country, but the underlying approach of identifying and targeting the key decision makers is transferable to other contexts.

The United Kingdom government's method of financing adaptation relies almost entirely on mainstreaming, with resources allocated through existing budgetary processes rather than having a "ring-fenced" adaptation fund. Cost-benefit analysis is already widely used to inform the allocation of government spending between different priorities. In principle, the benefits of adaptation measures should be reflected in the estimated benefits, which can then be weighed against any additional costs. A significant benefit of this is that it avoids the need to make the distinction between improving resilience to the current climate, and adapting to climate change. More generally, it is intended to ensure that adaptation investments represent an efficient use of public funds. An ongoing challenge with this approach is that, with the exception of flooding, there are major gaps in the evidence of the benefits of adaptation measures. This makes it challenging to justify investments in adaptation, and is likely to be an even more pressing issue for countries with less data available.

3.2. Mexico

Mexico has increased its policy response to climate change in recent years. The Mexican Government has established a multi-sectoral institutional environment to address climate change adaptation and to develop a national adaptation strategy. In 2005 the government established an Interministerial Climate Change Commission (CICC, Spanish acronym), and it identified climate change as a development priority in its National Development Plan 2007-2012 (PND, Spanish acronym). This Plan was accompanied with the development of a National Climate Change Strategy in 2007 (ENACC, Spanish acronym), which proposed adaptation and mitigation measures for all sectors. There was also a Special Programme on Climate Change 2009-2012 (PECC, Spanish acronym) intended to make the Strategy operational. In 2012, the Mexican Congress passed a General Law on Climate Change, which provides a regulatory framework to co-ordinate climate change activities in Mexico.

The country's climate change agenda has been dominated by mitigation policies. Mexico's geopolitical context in building a bridge between developing countries (non-Annex I under the UNFCCC) and developed countries (Annex I) indicates its influential role in international climate negotiations, which have traditionally stressed GHG reduction targets. The country's stand on climate change is also important in shaping the post-2012 climate regime.[12] In Mexico, adaptation to climate change has benefited from increasing attention and political commitment both at the international level, since the Bali Action Plan in 2007, and at the national level, since the development of its National Strategy and Programme.

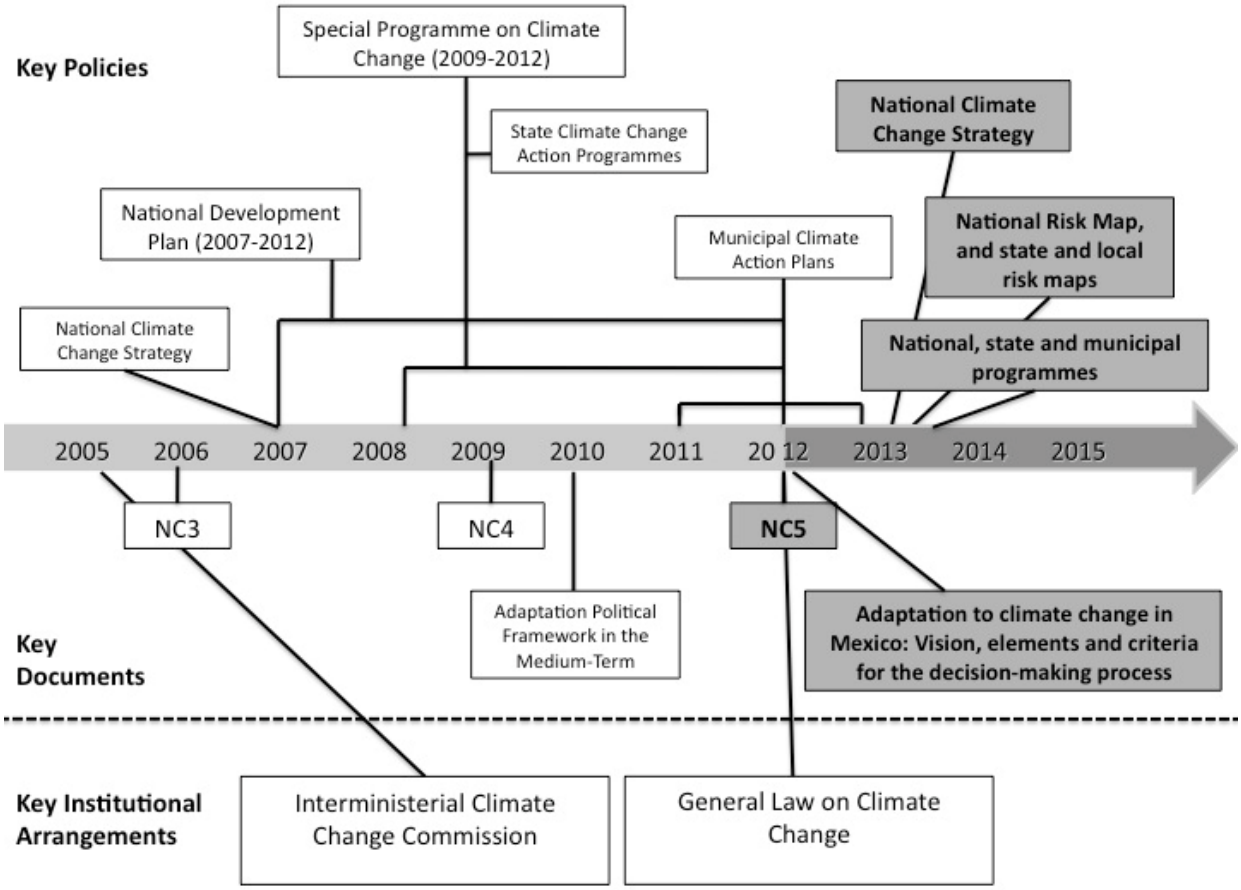
Advancing an effective national adaptation policy response is important due to Mexico's high vulnerability to climate impacts. Climate extremes events, such as tropical cyclones, floods and droughts, already cause significant loss of life and economic damages and are predicted to become more frequent and damaging under climate change. Between 2000 and 2011, there have been on average 154 deaths and about USD 1.5 billion in economic losses every year (CICC, 2012). Coastal zones are highly exposed to storm surges and sea-level rise, which threatens the development of millions of Mexicans who live near the 10 000 km of coastal area. In addition, rising temperatures and changes in precipitation are expected to cause water shortages, with negative effects on agricultural yield and severe water pressure in urban areas. Mexico also shows high social vulnerability to climate change, given that about half of its population lives under poverty and there is high inequality between rich and poor.

3.2.1. Adaptation policy in Mexico

Adaptation policy in Mexico has evolved from national impact and vulnerability assessments and the implementation of pilot adaptation projects to a co-ordinated policy response. Figure 3 presents the evolution of national policies on adaptation, its key programmes, documents and institutional arrangements.

[12] Mexico has already proposed the creation of a "Green Fund" under the UNFCCC to which all countries except the poorest would contribute, according to a scale based on ability to pay and GHG emissions. This proposal aims to generate new opportunities to access financial resources for adaptation and mitigation activities and to provide an incentive to transfer technologies for climate change to Mexico and developing countries.

Figure 3. Evolution of adaptation policy in Mexico



Mexico has demonstrated strong commitment to the international climate agenda. Not only has the Government submitted four National Communications to the UNFCCC,[13] but Mexico has also introduced climate change programmes at the national and state levels, and more recently at the municipal level.

Regulatory and Institutional Context

General Law on Climate Change

In 2012, the Mexican Congress introduced a new regulatory framework on climate change. The General Law on Climate Change defines roles and responsibilities for climate change policy (Mexican Government, 2012). For example, it establishes a National Climate Change System to co-ordinate climate policy from national, state and municipal governments and the national legislature. It mandates the creation of a new National Climate Change Strategy, to be published in 2013, to be followed by programmes to make the strategy operational at the national, state and municipal levels. The General Law identifies key objectives for reducing climate change vulnerabilities and increasing resilience in natural and social systems, including creating action plans for immediate support by civil protection agencies in areas affected by climate events, enhancing food security and productivity in agriculture, animal husbandry and fisheries, and preserving ecosystems and natural resources.

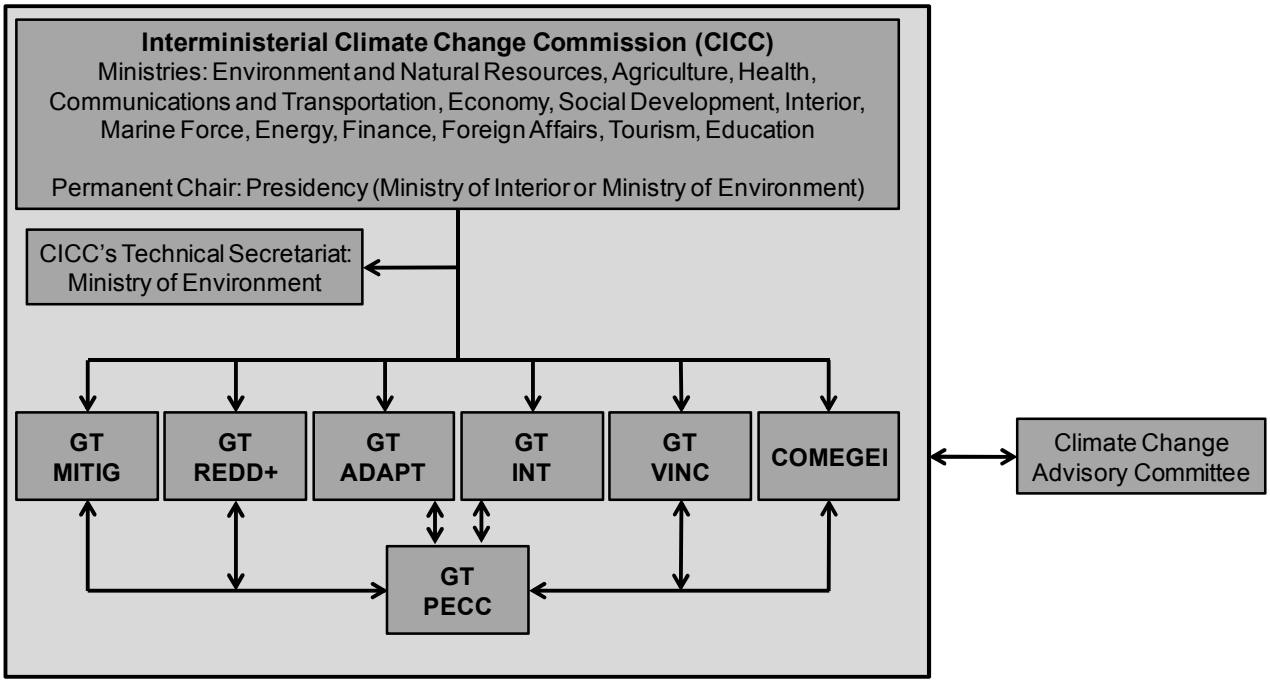
[13] Mexico's Fifth National Communication to the UNFCCC will be published in 2012.

The General Law on Climate Change will build on the preparatory and ongoing work of the Interministerial Climate Change Commission, the 2007 National Climate Change Strategy and the Special Programme on Climate Change.

The Interministerial Climate Change Commission (CICC)

To provide an institutional framework for climate policy, Mexico established the Interministerial Climate Change Commission (CICC) in 2005. The CICC was initially composed of 7 ministries, which increased to 13 following the passing of the General Law on Climate Change. Figure 4 outlines the members and structure of the CICC. The CICC was initially chaired by the Ministry of Environment, with a permanent Technical Secretariat Unit assigned to support its activities. In 2009, a Directive on Climate Change was established under the Ministry of Environment to follow up the implementation of the activities and policies agreed on by the CICC. It has assumed the previous responsibilities of the Technical Secretariat Unit to co-ordinate and provide support to the CICC. However, under the new regulatory framework the Presidency will chair the CICC, though the President can assign this position to the Ministry of Interior or the Ministry of Environment.

Figure 4. Interministerial Climate Change Commission (CICC), Mexico



Note: GT MITIG – Working group for mitigation policies; GT REDD+ – Working group for REDD; GT ADAPT – Working group for adaptation policies; GT INT – Working group for international policies; COMEGEI - Mexican Committee for the Mitigation and Capture of GHG Emissions; GT- PECC – Working group for the development of Special Climate Change Programme.

Source: Adapted from CICC, 2012.

The Commission is organised across different working groups. In October 2006, the Working Group on Adaptation Policy (GT-ADAPT, Spanish acronym) led by the National Institute of Ecology (INE)[14] was established. This Group's mandate is to develop national strategies and policies for adaptation. In order to

14 The INE is an agency under the Ministry of Environment and Natural Resources, which provides technical and scientific information and is dedicated to the development of human resources in the environmental sector. It is also the leading governmental agency working on climate change adaptation in Mexico.

include relevant sectors, it has expanded its membership to include other organizations that are not permanent members of the CICC but are important for the development adaptation policy, for example, the National Commission for the Development of Indigenous People (CDI, Spanish Acronym). An external group, the Consultative Council on Climate Change, composed of experts from the scientific community, the academic sector, the private sector and civil society, evaluates the CICC. It also provides recommendations and inputs to the Commission.

The CICC has facilitated a multi-sectoral dialogue and participation process with relevant stakeholders to develop and co-ordinate the National Climate Change Strategy and the Special Programme on Climate Change. All government institutions participating in the Working Groups of the CICC (see Figure 4) meet on a regular basis to follow up and co-ordinate activities. This includes workshops with the scientific community, members of civil society and authorities at the sub-national level. Moreover, the Special Programme on Climate Change has established mitigation and adaptation goals, and all institutions involved must monitor and report progress every two months through an online monitoring database system, the SIAT-PECC. It is important to note that the Special Programme on Climate Change was mainly developed at the national level, without substantial input from states and municipalities or the legislative body. The new law provides a more inclusive regulatory framework, where state and municipalities have to develop climate change strategies and programmes and the national government provides technical support and capacity building and is responsible for monitoring overall progress.

National Climate Change Strategy (2007)

Supported by the institutional framework of the CICC, the 2007 National Climate Change Strategy identified key actions to guide adaptation. These actions include activities to build the evidence base and capacity, such as designing and implementing climate modelling, designing a public information and education strategy, developing human resources in meteorology and climate forecasting, and reviewing current capacity to respond to climate variability. They also include policy actions, including reviewing existing institutional structures for managing hydro-meteorological risks, identifying opportunities for cross-cutting policies across sectors, enhancing the use of ecological land-use planning for adaptation, promoting insurance as a tool to reduce vulnerability, and reviewing policies and budgetary allocations to emphasise adaptation. The strategy also recommends promoting adaptation and risk-reduction activities in regional and local development plans.

Some of these actions depend on a legislative process, such as the use of ecological land-use planning and reviewing budgetary allocations to prioritise adaptation. There was initially limited involvement of the legislature in the development of the Strategy and its Programme, and the political support and consensus needed for regulatory changes was a challenge. The General Law on Climate change is designed to help overcome these barriers, as the National Climate Change System co-ordinating body includes members of the national legislature and has the mandate to provide recommendations to the CICC.

The insurance sector may also play an important role for adaptation. However, its effectiveness as an adaptation option relies on insurance premiums being set appropriately, i.e. they send signals to policy holders to undertake adaptation measures that reduce exposure to climate change. Poorly designed premiums that do not adequately reflect the underlying risk can impede adaptation or even promote maladaptation (Agrawala and Fankhauser, 2008). Currently the National Strategy and Special Programme do not clarify how the Mexican Government and the insurance sector will work towards a sustainable, long-term reduction of risks and vulnerability to climate change.[15] There is also limited participation of the private sector in adaptation strategies and plans in Mexico.

15 Mexico's Fifth National Communication will include an assessment of how the insurance sector is responding to climate variability and climate change in Mexico.

Special Programme on Climate Change (2009-2012)

To operationalise the priorities in the National Climate Change Strategy, the Special Programme on Climate Change identified seven main areas of investment for adaptation and one additional activity aimed at transforming disaster risk management. The areas of investment are: water resources management; agriculture, cattle, forestry and fisheries; ecosystems; energy, industry and services; transport and communications infrastructure; land-use management and urban development; health sector; and disaster risk management. The Programme also identifies measures on adaptation to enhance institutional responses for adaptation. Furthermore, it provides objectives, strategies and specific actions to link these actions with responsible agencies.

Table 3 provides an analysis of the measures proposed for adaptation in the Special Programme. It explores the areas of investment for adaptation, mainly in the development of assessments and implementation of actions. Table 3 also looks at the number of activities proposed for each category (marked by a grey scale) and identifies the level at which they apply (only national; national and state; or national, state and municipal).

Table 3. Adaptation measures proposed in the Special Programme of Climate Change

Area of Investment	Climate change impact assessments		Adaptation actions			
	Impact, vulnerability assessment	Identification of adaptation options	Enhancing institutional policy response (regulation, capacity development)	Formulation of adaptation policies/ enhancing existing policies	Adaptation projects	Mainstreaming adaptation
Disaster Risk Management	N+S	*N+S+M*	**N**	*N+S+M*		*N+S+M*
Water Resource Management	*N+S+M*	*N+S+M*	**N**	*N+S+M*		
Agriculture, Cattle, Forestry and Fisheries	N+S	**N**	**N**	N+S		
Ecosystems	**N**	N+S	**N**	N+S	N+S	
Energy, Industry and Services	*N+S+M*	*N+S+M*	**N**			
Transport and Communication Infrastructure			**N**	*N+S+M*		**N**
Land-use Management and Urban Development	**N**		*N+S+M*	**N**		
Health Sector	**N**		**N**	**N**		
General (enhancing institutional policy response)		**N**	N+S		N+S	
Research & Development	**N**		**N**			

Note: Dark-grey fields highlight an extensive number of activities (>6), light-grey fields a moderate number of activities (1-5), white fields state that no activities were proposed in this area. The main level(s) of impact are either national (**N**), national and state (N+S) or national, state and municipal (*N+S+M*).

Table 3 shows that from 2009 to 2012, the Mexican Government has invested primarily in areas related to the vulnerability and impact assessments for disaster risk management and ecosystems. Other key investments have included: water resource management; agriculture, cattle, forestry and fisheries; and ecosystems. Activities to mainstream adaptation at the municipal level have been almost entirely absent from the Programme. Nevertheless, a recent initiative at the municipal level, the Municipal Climate Action Plan (PACMUN, Spanish acronym) has been created for the period 2011-2013, led by ICLEI-Local Governments for Sustainability in Mexico, with technical support from INE and financed by the British Embassy. This initiative includes pilot plans in 200 of the 2434 Mexican municipalities.

The Special Programme on Climate Change (2009-2012) also created a long-term working framework for adaptation with a vision until 2050. This framework is articulated in three phases:

1. *First Phase (2009-2012)*: National vulnerability assessments for all relevant sectors and regions and economic assessment of all actions identified as priorities. The main objective of this phase is the establishment of a national adaptation risk management system.

2. *Second Phase (2013-2030)*: The objective is to enhance the adaptive capacity of sectors and regions and to enhance the climate resilience of ecosystems. This includes adopting sustainable production methods for agriculture, cattle, forestry and fisheries, and establishing programmes to relocate human settlements or infrastructure exposed to high climate change risks.

3. *Third Phase (2031-2050)*: This phase aims to consolidate capacity to increase forest coverage, move into a sustainable development pathway and consolidate a national planning system that would reduce overall vulnerability to climate change. (CICC, 2009)

The three phases are based on an institutional response and the creation and enhancement of four national response systems:

- *National disaster risk management system*, which should include a long-term holistic approach to reduce the impacts of climate variability and climate change;

- *National land-use planning system* with a regional sustainability approach and that includes the relocation of those communities most exposed to climate risks;

- *National coastal protection system* that considers a 20 cm sea-level rise scenario for 2050;

- *National development planning system*, which includes land-use and spatial planning for developing productive activities, a vision for sustainable use of natural resources and ecosystems, and the conservation of environmental services (CICC, 2009).

The General Law on Climate Change also mandates the development of a new National Climate Change Strategy in 2013. A new Administration will be also in power, which will create an opportunity to review progress made so far and to assess the overall goals and long-term strategy on climate change.

3.2.2. Successes to date

The Mexican adaptation programme has only recently been adopted, making it difficult to evaluate its overall performance. However, some of the emerging successes to date that have led to the development of an institutional, regulatory, strategic and budgetary environment are described below.

Sustained national efforts to enable climate change information

Mexico is the only developing country that has already submitted four National Communications to the UNFCCC. *The Economics of Climate Change in Mexico* (also called the "Mexican Stern Report") has also contributed to the building up of a solid base of climate information in recent years (Galindo, 2009).[16] Despite these efforts there are still important information gaps at the regional, local and sectoral levels. However, the country is making substantive progress in the generation of relevant information for use in decision-making processes. For example, there are guidelines to develop climate change programmes at the

16 This report provides an economic assessment of costs of mitigation actions and climate impacts in Mexico. It estimates that by 2050 the cost of climate change will represent 3.2% of the GDP in Mexico (Galindo, 2009). However, more recent studies estimate much higher costs of 6% of the GDP by the end of the century (Estrada, Tol and Gay-García, 2011).

state and municipal levels (INE-SEMARNAT *et al.*, 2008; SEDESOL, 2012). These efforts have contributed to specific actions for adaptation, such as the development of the National Climate Change Strategy and the Special Programme on Climate Change.

Solid national institutional architecture for adaptation

The CICC and its working group on adaptation have consolidated a permanent institutional space for dialogue and co-ordination between relevant sectors and stakeholders for adaptation policy responses at the national level. Significant achievements include the development of a National Climate Change Strategy and the Special Programme on Climate Change. Both processes have created a set of specific activities on adaptation that are supported by the national budget. Moreover, the General Law on Climate Change expands the adaptation response through its mandate to develop climate change programmes from the national to the municipal levels, and an institutional framework to co-ordinate adaptation policy.

The Special Programme also aimed to develop strong institutional structures across the relevant parts of national government. The Ministry of Environment has reinforced its structures to respond more effectively to the increasing demands regarding climate change, arising from the work of the CICC. The Ministry of Agriculture has also created a General Directive on Climate Change. However, as of August 2012, most other ministries playing an important role on adaptation, for example, health, tourism or energy have not created new structures to support adaptation activities.

At the same time, both the National Climate Change Strategy and the Special Programme include participatory mechanisms. The CICC has engaged technical experts and leaders from civil society through its Consultative Council on Climate Change. For example, both processes are open to receive written comments from the public. Additionally, people with recommendations have been invited to meetings to discuss the draft of the Strategy and the Programme. These mechanisms have enriched the process with the participation of representatives from civil society, the scientific community and leaders from different sectors.

State and municipal level programmes on climate change

To integrate adaptation at the state level, the Special Programme on Climate Change proposed a State Climate Change Action Programme. The preparation of these Programmes by states has proved to be an attractive option, with 31 out of 32 states currently engaged in a process to develop their own programmes.

The INE has published guidance for the development of State Climate Change Action Programmes and has provided training for staff in all states to enable them to engage in the process. At the municipal level, the Municipal Climate Action Plans, led by ICLEI-Local Governments for Sustainability in Mexico with technical support from INE, have concluded a first phase of activities with (a) the development of a *Guide for the Preparation and Implementation of Municipal Climate Action Plans* and (b) 30 initial pilot programmes in municipalities in 2012. In 2013, this municipal programme aims to include more than 200 municipalities (PACMUN, n.d., 2012). The General Law on Climate Change requires that states and municipalities establish climate change strategies and programmes in co-ordination with the National Development Plan, the National Climate Change Strategy and its Programme. This new regulatory framework therefore enhances sub-national authorities' responses to climate change.

3.2.3. Challenges

The Mexican experience in implementing an adaptation programme has revealed challenges that will need to be faced to adopt a comprehensive national adaptation programme. As the Mexican adaptation strategy and programme was initially developed at the national level, the inclusion of municipalities

remains a challenge. Other challenges relate to the political framework and the degree of social inequality in the country.

Adapting municipalities to climate change

There are few political incentives in Mexican local governments for long-term planning. The absence of a permanent career structure at the local level leads to a high rotation of civil service personnel. For example, mayors follow a three year term with no possibility of re-election. In addition, the State Climate Change Action Programme does not ensure a permanent co-ordination and collaboration between national and state governments and municipal governments. The General Law on Climate Change provides opportunities to expand adaptation strategies, plans and actions at the state and municipal levels. Nevertheless, it is too early to evaluate if these will create long-term multi-level co-ordination enabling collaborative "bottom up" and "top down" planning.

At the same time, Mexican municipalities are constrained by low technical capacity to address climate change adaptation in their decision-making processes. While in principle there is no obstacle to establishing capacity-building measures at municipal levels, the Special Programme on Climate Change has few activities directly promoting the mainstreaming of climate change adaptation at the local level. One such activity has established a distance learning programme on climate change to enhance municipal staff capacity. Although such measures might be complicated by the relatively frequent turn-over among municipal civil service staff, not all staff leave their positions at the same time. These activities could therefore increase the capacity of the staff in the short-term, although more action may be required to ensure a permanent enhancement of the capacity to adapt at the municipality level.

In principle, municipalities should play an important role in adaptation to climate change due to their key role in urban development, service provision and local planning. However, most adaptation activities require sustained resources and long-term planning. The Municipal Climate Action Plan's main challenge is to build and sustain technical capacities and create long-term incentives for municipalities to work towards a strategic approach to adaptation.

Regulatory changes in a divided congress

There is an urgent need to revise current legislation to enhance adaptive capacity in Mexico. In 2008, the Mexican Congress, together with leading research institutions, civil organisations and the United Nations Development Programme (UNDP), launched the *Dialogue for the Construction of Agreements: Climate Change and National Security*. This Dialogue identified the following priority areas that require revision to enhance climate change mitigation and adaptation:

- Poverty and inequality,
- Water resources,
- Land-use management,
- Sustainable economic development.

The Dialogue resulted in 68 proposals to modify the regulatory framework. However, since 1997 Mexico has had a highly divided Congress with no party holding a majority, which leads to the challenge of agreeing on a common legislative agenda. The development of the National Climate Change Strategy and its Special Programme did not involve the legislature, implying that there was little support for the necessary legislative reforms. A first challenge is to build political support for legislative modifications. The recently passed General Law on Climate Change demonstrates that there is general support across the different political parties to include climate change as a national priority. Nevertheless, urgent

modifications on regulation linked to land-use management and water management, which are key for adaptation policy in Mexico, may confront high barriers to achieve the political consensus needed for action.

Social vulnerability to climate change: poverty and social inequality

The most serious challenge for Mexico is managing and adapting to climate change in the context of growing poverty and inequality. The financial crisis has increased poverty levels and social inequality, which result in a higher social vulnerability to extreme weather events and climate change impacts. It is estimated that 68% of the population affected by natural disasters in Mexico is poor, due to higher exposure linked to low quality housing and a tendency to live in areas that are more exposed to climate risks (for example, flooding or landslide risk areas) (Giugale, Lafourcade and Nguyen, 2001; CICC, 2012). Moreover, poor communities in Mexico have limited access to high quality education and health services or to insurance, which increase adaptive capacity to climate risks. Adaptation to climate change will only be successful if it succeeds in effectively reducing the social vulnerability in poor communities with low adaptive capacity, which are most at risk.

Transferability

Mexico's investment in building a solid climate change information base during the past two decades has lead to long-term political engagement and support for climate policy at the national level. Despite some information gaps at the regional and sectoral levels, Mexico has showed sustained commitment to supporting the decision-making process on climate change. The national approach to respond to climate variability impacts based on a current capacity assessment could be replicated by other countries. Such an assessment can be used as foundation to build greater adaptive capacity to climate change.

The Mexican institutional framework based on a multi-sectoral approach could also be adopted by other countries. In Mexico, the institutional structure balances individual departmental actions with strong central co-ordination. The core ministries engage relevant sectors and actors at all levels, and are brought together through the CICC and its working groups, with political support from the executive office. This approach combines departmental allocation of responsibilities with a strong institutional mechanism for co-ordination, and would be transferrable to other countries with strong independent departmental structures.

Finally, Mexico has allocated most of its adaptation investment to programmes and projects that can reduce vulnerability while moving towards more sustainable use of natural resources. While it may be too soon to assess the overall success of the Special Programme on Climate Change, it has already helped to mainstream adaptation in key sectors for adaptation planning and to initiate activities at state and municipal levels. Moreover, any move towards a more sustainable use of water and natural resources and the conservation of ecosystems and environmental services will bring important co-benefits and greater resilience to climate change, both for Mexico and for other countries which follow this approach.

3.3. United States

Over the past several years, the United States federal government has increasingly recognised the impacts that global change has and will continue to have on its operations, missions, and infrastructure and has taken a leadership role towards planning for these current and future impacts. Major federal initiatives include (but are not limited to):

- Creation of an Interagency Climate Change Adaptation Task Force to provide guidance to federal agencies and develop national principles for adaptation.

- Issuance of Executive Order (EO) 13514 on *Federal Leadership in Environmental, Energy, and Economic Performance* by President Obama to strengthen sustainability policies and programs (including both climate change mitigation and adaptation) (United States President, 2009).

- Development of sector-specific and societally relevant national adaptation strategies designed to address specific challenges posed by a changing climate that encompass the jurisdictions and missions of multiple individual federal agencies, including challenges such as management of freshwater resources, fish, wildlife and plants, and marine and coastal regions.

- Development by federal agencies of agency-specific climate change adaptation plans in conjunction with the development of more comprehensive sustainability plans required by EO 13514.

- Development and implementation of a decadal *National Global Change Research Plan* that identifies goals of advancing science, informing adaptation and mitigation decisions, sustaining national and international climate assessments, and communicating and educating the United States on current and future climate change-related impacts (USGCRP, 2012).

Across the federal government, agencies are in the initial stages of adaptation planning and implementation through these initiatives. These collaborative efforts provide a framework for federal agency action to adapt to climate change across the full spectrum of mission areas, including infrastructure development, economic growth, protecting human health and safety, disaster preparedness, protection of the environment, and national security.

These federal efforts are an important part of adaptation efforts in the United States, but are still only one piece of a larger effort that includes action at all levels of government, including state, local, city and tribal levels, as well as action by the private sector. In addition to managing its own adaptation planning, the federal government supports and complements the multitude of adaptation activities already ongoing at other levels of government through a variety of efforts, including providing data, information, tools and best practices.

This paper focuses on high-level federal government adaptation science, assessment, planning, and support initiatives, while providing some illustrative examples of adaptation implementation activities ongoing at the state, regional, tribal, and local levels.

Climate change impacts in the United States

The 2009 National Climate Assessment, *Global Climate Change Impacts in the United States,* conducted by the United States Global Change Research Program (USGCRP), stressed that the United States is already experiencing changes to its climate, and that these are projected to grow in the future (USGCRP, 2009). The United States is a geographically and climatically diverse country, which will therefore experience a wide range of climatic impacts. Some common projected challenges include: increasing stresses on water resources (due to droughts, flooding and declining mountain snowpack); challenges to agricultural production (due to water shortages, pests and diseases, and weather extremes); sea-level rise and storm surge risks in coastal areas; and risks to human health (due to heat stress, diseases, poor air quality and extreme weather events) (USGCRP, 2009).

In addition to these general impacts, there are projected to be a large number of specific geographic and sectoral challenges – for example, increasing intensities of North Atlantic hurricanes, an increasing number of snowstorms in the Great Lakes area over the coming decades (though they are likely to decrease in the longer term due to increasing temperatures), and increasing political conflict over water allocations

due to increasing severe water scarcity in southwestern states. These impacts highlight the need to ensure that the whole country is prepared for climate change impacts and is taking prompt action to reduce the consequences of a changing climate on the environment, society, and economy.

3.3.1. Adaptation programme in the United States

Interagency Climate Change Adaptation Task Force

Initially, a small number of science- and natural resource management-focused federal agencies – such as the Department of the Interior (DOI), Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), among others – took the lead on adaptation planning and implementation, focusing on their own operations and programs. However, recognition of the true impacts of climate change on the well-being and economic health of the United States and its citizens, emerging activities by federal agencies on sustainability (both adaptation and mitigation efforts), and increasing interest in adaptation led to the convening of the Interagency Climate Change Adaptation Task Force (the Task Force) in spring 2009 by the Obama Administration. Co-chaired by the White House Council on Environmental Quality (CEQ), the Office of Science and Technology Policy (OSTP), and NOAA, the Task Force is made up of the three convening agencies, plus over 20 other federal agencies and offices.[17]

The work of the Task Force has been guided by a strategic vision for a resilient, healthy, and prosperous United States in the face of a changing climate. Established to assess key steps to help the federal government understand and adapt to climate change, the Task Force has played an important leadership and co-ordination role in federal adaptation activities. It directly supports adaptation efforts related to natural resource management, international development, non-federal outreach and support, and regional co-ordination of federal agency efforts (Interagency Climate Change Adaptation Task Force, 2011a). To support these efforts, in its 2010 report to President Obama, the Task Force identified a set of guiding principles that should be considered by all levels of government, communities, the private sector, and others in designing and implementing adaptation strategies. These are: adopt integrated approaches; prioritise the most vulnerable; use best available science; build strong partnerships; apply risk management methods and tools; apply ecosystem-based approaches; maximise mutual benefits; and continuously evaluate performance and outcomes (Interagency Climate Change Adaptation Task Force, 2010). Additionally, several working groups and a practitioner-level community of practice have formed to support the work of the Task Force and to facilitate knowledge sharing, training, and capacity development.

Executive Order to promote sustainability across federal agencies

Signed on October 5, 2009, Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, set out to 'establish an integrated strategy towards sustainability in the Federal government and to make reduction of greenhouse gas (GHG) emissions a priority for Federal agencies' (United States President, 2009). It also directs agencies to work together to address the impacts of climate change, including participating in the Interagency Climate Change Adaptation Task Force. As required under EO 13514, all federal agencies were tasked with developing Strategic Sustainability

[17] In addition to the CEQ, OSTP, and NOAA, other Task Force members include: Department of Agriculture; Department of Commerce; Department of Defense; Department of Education; Department of Energy; Department of Health and Human Services; Department of Homeland Security; Department of Housing and Urban Development; Department of the Interior; Department of State; Department of Transportation; Department of the Treasury; United States Agency for International Development; EPA; National Aeronautics and Space Administration; National Intelligence Council; White House Office of Energy and Climate Change; National Security Council; Office of Management and Budget; White House Council of Economic Advisors; National Economic Council.

Performance Plans (Sustainability Plans). These plans have been submitted annually since 2010, and include goals related to improving energy and water efficiency, reducing greenhouse gas emissions and better managing federal buildings and fleets.

EO 13514 also directed federal agencies 'to evaluate agency climate change risks and vulnerabilities to manage the effects of climate change on agencies' operations and mission in both the short- and long-term'. As a result, as part of their 2012 Sustainability Plan reporting, for the first time federal agencies were required to include Agency Adaptation Plans (CEQ, 2011). These plans detail their policy framework for adaptation efforts, provide an analysis of vulnerability (taking into account agency mission, programs, and operations, and impacts in both the short- and long-term), and also detail the process of adaptation planning involved at the agency-level.

Interagency climate change research, assessments, and adaptation

A further component of federal adaptation initiatives are interagency collaborations to further adaptation science and decision-making frameworks. As a joint initiative among thirteen federal agencies, the United States Global Change Research Program (USGCRP) is a key arena for collaborative research to support agencies' responses to climatic change.[18] The USGCRP was codified by the Congress in the *Global Change Research Act* of 1990, which called for 'a comprehensive and integrated United States Research Program, which will assist the nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change' (United States Government, 1990). Over the past 20 years, the research conducted within the USGCRP has contributed substantially to an improved understanding of the natural and human-induced changes in the global environment and their effects on society. Several programmes within the USGCRP co-ordinate the science, assessments, and decision-support tools for adaptation, including the National Climate Assessment (NCA).

The NCA is an important resource for understanding and communicating climate change science and impacts relevant to the United States. It provides information on observed changes, the current status of the climate in the context of global change, and anticipated trends for the future. The NCA provides a sound foundation for federal agency planning related to climate change, including cross-cutting plans and agency specific plans. As required by the *Global Change Research Act*, every four years the NCA process integrates scientific information from multiple sources to highlight key findings and significant gaps in knowledge. The NCA also establishes consistent methods for evaluating climate vulnerabilities, impacts, and response strategies in the United States, in the context of broader global change. The NCA is a critical process to identify research gaps and needs, and to incorporate this feedback into the USGCRP's research agenda on an ongoing basis. Finally, local and state governments, tribes, businesses, and the public use findings from the NCA as an input to planning processes.

3.3.2. Successes to date

As stated above, many of the United States' federal adaptation initiatives are still at a preliminary planning stage. However, there have been some early successes and milestones towards the development of co-ordinated national and local adaptation efforts. For example, a key recommendation of the recent *National Action Plan* for managing freshwater resources was for the establishment of an advisory group of non-federal stakeholders to advise federal agencies on water and climate adaptation issues (Interagency Climate Change Adaptation Task Force, 2011b). This new stakeholder group was recently established as a

[18] USGCRP members: Department of Agriculture; Department of Commerce; Department of Defence; Department of Energy; Depart of Health and Human Services; Department of the Interior; Department of State; Department of Transport; Environmental Protection Agency; National Aeronautics and Space Administration; National Science Foundation; Smithsonian Institution; United States Agency for International Development.

part of the Advisory Committee on Water Information. In addition to federal-level activities, progress has also been made at regional, state, local and tribal levels.

Agency-specific climate change adaptation policies and plans

Subsequent to the October 2009 Executive Order, the CEQ issued Implementing Instructions for federal agencies conducting adaptation planning in compliance with the Executive Order. While recognising that adaptation planning differs across agencies to reflect their varying missions and operations, the Implementing Instructions set out common objectives, reinforced the Guiding Principles, and called for the development of official adaptation policy statements by most federal agencies (CEQ, 2011). The support and guidance provided by the CEQ has helped to harmonise agency-level adaptation policies and set standards for compliance. While several agencies were engaged in adaptation prior to the development of the interagency federal adaptation initiative, the facilitative role played by the Task Force has provided guidance and further encouragement to these agencies, and enabled adaptation planning throughout the federal government.

Development of cross-cutting national adaptation strategies

In its 2010 report to President Obama, the Task Force called for collaborative approaches to address key cross-cutting issues related to climate change adaptation (Interagency Climate Change Adaptation Task Force, 2010). In response, three national-level strategies have been or are in process of being developed. Released in October 2011, the *National Action Plan: Priorities for Managing Freshwater Resources in a Changing Climate* will help water resource managers ensure adequate water supply, protection of health and property, and maintenance of the quality of freshwater resources as the climate changes (Interagency Climate Change Adaptation Task Force, 2011b). Published in March 2013, the *National Fish, Wildlife, and Plants Climate Adaptation Strategy* provides a framework for unified action to safeguard species and natural systems, as well as the important benefits and services the natural world provides, such as jobs, food, clean water, and opportunities for recreation (National Fish, Wildlife and Plants Climate Adaptation Partnership, 2012). The draft *National Ocean Policy Implementation Plan* includes several actions to ensure the protection, maintenance, and restoration of United States' oceans, coasts, and Great Lakes and the communities that live on and depend on them. The plan includes efforts to strengthen their resiliency and adaptability to the impacts of climate change and ocean acidification (National Ocean Council, 2012).

Sustained efforts to enhance climate change science and better inform decision makers

Federal adaptation initiatives incorporate multiple avenues for improving understanding of climate change impacts and risks. In addition to agencies' individual climate vulnerability assessments, the USGCRP's joint research efforts have increased understanding of climate impacts and science. For example, in recent years the USGCRP has conducted primary research and hosted workshops on vulnerability assessments, on physical and societal indicators, and on decision making under scientific uncertainty (USCCSP, 2009; USGCRP 2009, 2011a, 2011b, 2011c). These research efforts will be sustained in the future, including the 2013 National Climate Assessment and research on adaptation science and decision making, which have been included as strategic goals within the USGCRP's research plan for 2012 to 2021 (USGCRP, 2012). Significant steps have also been taken to collaborate and share information and both within and between agencies, such as through intra-agency workshops, projects, and research.

As required by the Global Change Research Act, in April 2012 the USGCRP released the new National Global Change Research Plan 2012 – 2021: A Strategic Plan for the U.S. Global Change Research Program. The Research Plan is built around four strategic goals: 'Advance Science', 'Inform

Decisions', 'Conduct Sustained Assessments', and 'Communicate and Educate'. In addition to these four goals, the Plan emphasises the importance of national and international partnerships that leverage federal investments and provide for the widest use of Program results. The Plan builds on the Program's strengths in integrated observations, modelling, and information services for science that serves societal needs (USGCRP, 2012).

Federal agency-level integration of adaption into operations and activities

While the Task Force provides co-ordination and guidance, federal agencies are individually responsible for identifying risks to their missions and operations as a result of a changing climate, and for implementing adaptation activities to improve their capacity to manage these risks. Several agencies have programs underway to address these issues and pilot new approaches and methods, some of which are longstanding efforts. For example, in 2009 the United States Army Corps of Engineers developed guidance on 'Incorporating Sea-Level Change Considerations in Civil Works Program', which is periodically updated to reflect advances in science and policy (US Army Corps of Engineers, 2011)

In addition to agency-wide actions, sub-agencies and specific offices conduct adaptation activities. The extent of individual offices' engagement reflects their particular operations and need for adaptation. For example, the EPA Office of Water (OW) has developed a strategy for identifying and developing adaptation responses to climate impacts on drinking water security and on water body quality and safety. The Department of Transportation (DOT) Federal Highway Administration (FHWA) has convened a working group on adaptation, conducted targeted research on climate change impacts on transportation infrastructure, and is conducting pilot projects to help develop a conceptual model for assessing the vulnerability and risk of climate change effects on transportation infrastructure. While adaptation planning and implementation has been varied within agencies, to a degree this reflects that adaptation is a priority issue for those sub-agencies or offices that have taken action, which is in line with the Task Force's principle that priority issues be addressed first.

Beyond the national and federal levels, agencies also implement adaptation at state, regional, and local levels, working with local stakeholders. Regional offices and state agencies play key roles in designing and implementing localised adaptation programs, sometimes in conjunction with agency-wide offices. For example, the DOT's FHWA shares information and tools with state DOTs and city planners, including climate projections and methodologies for identifying critical assets. Federal agencies also play key roles in engaging with stakeholders and supporting their adaptation efforts. For example, the EPA OW's Climate Resilience Evaluation and Assessment Tool (CREAT) and Climate Ready Water Utilities program highlight the EPA's efforts to engage stakeholders in adaptation decisions and to provide them with support tools for addressing climate risks and impacts. Recognising the importance of these regional and local level actions by federal agencies, the Task Force is focusing on improving the efficiency and effectiveness of regional delivery of adaptation science and services to local decision makers.

3.3.3. Adaptation planning and implementation at state, regional, tribal, and local levels

Although climate change impacts can be felt at national levels, many are more pronounced and their effects felt more keenly at local levels. In addition, in the United States, state, local and tribal governments have the authority and responsibility for many decisions requiring adaptation action, such as infrastructure investments, local land use planning and zoning, and emergency management. As a result, across the United States many communities are taking their own action on adaptation, and developing innovative tools, methods and policies that can be shared nationwide. These actions are not controlled or even necessarily co-ordinated at the federal level, although federal agencies are often involved in supporting these efforts, and they can feed into voluntary networks of best practices and information (both government sponsored and not). The Task Force has recognised both the need for local action and the

potential for efforts at all levels of government, as well as in the private sector, to provide effective adaptation solutions. It has focused on supporting community adaptation efforts and helping them to build resilience to climate change by integrating adaptation considerations into relevant federal programs.

State adaptation initiatives

Many states have started to take action on their own initiatives to address climate impacts. As of July 2012, 14 states had completed adaptation plans and two more were in the process of developing an integrated adaptation plan (Center for Climate and Energy Solutions, 2012). Additionally, seven states have adaptation plans recommended as part of their broader state Climate Action Plans.[19] The state of Washington provides an example of leadership in adaptation planning at the state level, having recently released a completed adaptation plan. As early as 2007, working groups were formed as part of the state's overall Climate Advisory Team focusing on assessment of vulnerabilities and the need for adaptive action. In May 2009, Washington's Governor Christine Gregoire signed state legislation requiring an integrated climate change response strategy and implemented an executive order calling for an evaluation of the potential impacts from sea level rise on the state's coastline, along with development of recommendations to address those impacts (Washington State Government, 2009). In April 2012 the Washington Department of Ecology released its full climate adaptation report, *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy* (Washington State Department of Ecology, 2012). The report offers recommendations on how existing state policies and programs can better prepare the state to respond to the impacts of climate change.

Regional adaptation initiatives

Working across state and local boundaries enables regional-level adaptation strategies to integrate human and natural systems, connecting resilience efforts with broader ecosystem-scale efforts. For example, in 2009 four counties in southeast Florida, with a population of over 5.5 million people and accounting for over one-third of Florida's total economy, signed a regional compact to co-ordinate mitigation and adaptation activities across county lines (Adams and Gregg, 2010). The *Southeast Florida Regional Climate Change Compact* acknowledges that the region's shorelines are vulnerable to sea level rise and other climate change impacts where the four counties share coastal boundaries and resources, such as the Everglades and coral reefs. The Compact calls for the counties to work cooperatively in order to develop a climate response strategy for the region, while also providing an efficient means for state and federal agencies to engage with technical assistance and support.

Tribal adaptation initiatives

Planning for adaptation to climate change is also taking place at the tribal level across the United States. For example, the Swinomish Tribe has recently produced an adaptation plan to address potential impacts to the Swinomish Indian Reservation, located on Puget Sound in the state of Washington, from climate change (Swinomish Indian Tribal Community Office of Planning and Community Development, 2012). The Tribe is also facilitating the development of the Skagit Climate Science Consortium, which works to assess ongoing research, to identify gaps in the science, to develop Skagit River Basin-specific climate models, and to explain those models to local decision makers. This is just one example of many

[19] The 14 states with completed adaptation plans are: Alaska, California, Connecticut, Florida, Maine, Maryland, Massachusetts, New Hampshire, New York, Oregon, Vermont, Virginia, Washington, and Wisconsin. Adaptation plans are in progress in Connecticut and Minnesota. The seven states with Climate Action Plans that recommend adaptation are: Arizona, Colorado, Iowa, Michigan, North Carolina, South Carolina, and Utah.

adaptation initiatives that tribes and Native American groups have been working on at the regional and local level.

Local adaptation initiatives

Some of the most serious impacts of climate change are felt most strongly at the community level. Many United States cities are at the forefront of adaptation planning and implementation. In 2010, ICLEI – Local Governments for Sustainability USA launched their Climate Resilient Communities program to help cities study the effects of climate change and find new ways of financing adaptation (ICLEI USA, 2010). One city involved in this program is Philadelphia. In 2007, the city of Philadelphia developed its Local Action Plan for Climate Change, which reinforced the city's commitment to initiatives such as the "US Conference of Mayors Climate Protection Agreement" and the Clinton Climate Initiative, and committed the city to work toward greenhouse gas emission reduction targets as well as adaptation planning (City of Philadelphia Sustainability Working Group, 2007). The city has taken an integrated approach to adaptation planning, for example, implementing new initiatives in green infrastructure improvements through its *Green City, Clean Waters* program (Philadelphia Water Department, 2011). The northeastern United States is projected to experience increases in overall precipitation levels as well as in the frequency and duration of intense storms, with related impacts to drinking water quantity and quality, precipitating the need for better stormwater management. The Philadelphia Water Department has implemented a "land-water-infrastructure" approach through the *Green City, Clean Waters* program in order to achieve its watershed management goals. This approach focuses on using a variety of grey and green infrastructure projects, such as using soil-water-plant systems and constructing roads out of porous pavement to intercept stormwater, infiltrate a portion into the ground, evaporate a portion back into the air, and release a portion slowly into the sewer system (Philadelphia Water Department, 2011). The EPA has partnered with the City of Philadelphia to advance these green infrastructure projects and support urban wet weather pollution control (City of Philadelphia and EPA, 2012). As part of its *Green 2015* program, the Philadelphia has also committed to increasing the amount of green space throughout the city in order to help reduce the heat island effect and increase resilience to flooding (PennPraxis, 2010).

3.3.4. Challenges

While adaptation in the United States involves many actors at many levels, both inside and outside of government, the Task Force's and federal agencies' experiences in implementing national-level adaptation initiatives have shed light on several challenges to co-ordinating adaptation at a national level. In addition to these challenges, there is also the key challenge of managing and co-ordinating the interactions between the federal initiatives and state, local and tribal actions. This includes key questions around co-ordinating approaches, providing relevant information, and the appropriate role for the federal government in supporting action by other levels of government and the private sector.

Resources and capacity

Federal agencies face financial limitations to implementing adaptation. Many of them face increased financial pressures due to static or decreasing budgets, which affect their ability to invest in adaptation planning and implementation. Similarly, budget cuts or freezes may lead to reductions in staff and decreased ability to use external inputs or services, which also increases pressures on remaining personnel. Faced with maintaining existing programmes and services (including meeting statutory requirements) with reduced financial and human capital, agencies may not be able to dedicate funds and time to adaptation, or may not prioritise it relative to other activities. However, in the face of financial pressures some are already taking pragmatic steps to live within or overcome these constraints. For example, they have planned for adaptation measures that require no additional funds, they have integrated and mainstreamed adaptation within existing programmes, and they have collaborated with other agencies and bodies to share the costs

of adaptation research and planning. More work is needed to allow agencies and others to evaluate the costs of inaction versus adaptation action and the costs of different types of actions, to ensure they can make smart decisions about investing their limited resources.

Public awareness and political support

Agencies have found that a lack of public awareness of climate impacts and the need for adaptation – and in some cases uncertainty about whether global warming is occurring – has been a constraint to implementing adaptation. While many key stakeholders and partners tend to have a good awareness of climate impacts and support adaptation, agencies have found it more difficult to secure public support for adaptation. This is particularly the case when proposed adaptation measures would lead to additional (short-term) costs or restrictions on activities.

There is also political debate in the United States around climate change and the appropriate policy response to it. While this has predominantly focused on GHG emissions and mitigation, adaptation has also been subject to some controversy. This political debate has created challenges for the planning, financing and implementing of adaptation in the United States. This political environment highlights a potential risk in relying on a single political office (the White House) for primary support and leadership of adaptation – it makes progress in adaptation dependent on the extent to which it remains a priority for that office.

Evaluating and monitoring adaptation actions

The effectiveness of climate change adaptation has seldom been evaluated, as actions have only recently been initiated, and comprehensive evaluation metrics do not yet exist. Mainstreaming adaptation actions also makes it difficult to separate the effects of adaptation actions from other policy effects. To date, many evaluation and monitoring efforts have focused on the creation of process-based rather than outcome-based indicators. However, the USGCRP's Adaptation Science Workgroup has begun research around evaluation of effective adaptation actions in an effort to provide useful evaluation guidance to the federal agencies developing their adaptation plans. In addition, a number of efforts are underway to create indicators related to climate adaptation, including work by the EPA and the Department of Agriculture and the USGCRP's National Climate Assessment.

Transferability

The United States' approach to adaptation in the federal government draws on the convening and co-ordinating strengths of the White House to enable and encourage adaptation. This approach helps ensure that common principles and approaches are used across the federal government and that adaptation planning meets minimum standards. This approach could potentially be transferable to many other countries, particularly those with presidential systems of government or where the executive has the ability to implement policy measures by executive order. This approach may also be particularly relevant for contexts where political debate about climate change affects the possibility of enacting adaptation legislation. However, this centrally co-ordinated approach may work less well in governmental systems where there is already a body responsible for national adaptation planning – for example, where adaptation is the purview of environmental departments.

Additionally, other countries may wish to institute similar policy instruments for adaptation planning to those the United States has implemented to help to overcome rigid departmental structures and capacity constraints while still benefitting from departments' expert knowledge and decentralisation, in the absence of formal mechanisms for inter-departmental collaboration. The Executive Order and associated implementing instructions and guidance ensure minimum standards across departments, while also boosting departments' technical capacity conduct adaptation planning. At the same time, these policy

instruments also allow for heterogeneity in the specifics of departmental responses, which enables them to draw on their particular expertise and plan for the climate impacts that are most important for them. The establishment of ad hoc groups to produce adaptation guidance on cross-cutting issues, such as freshwater resources, also enables responses to critical issues that cross traditional departmental boundaries without a need for formal collaboration systems. This approach to adaptation planning would be applicable for other countries that want to implement a sufficiently rigorous yet flexible adaptation programme without a formalised adaptation strategy or plan.

Adaptation efforts in the United States combine direction from the federal government with initiatives from the state and local level. These local and state level initiatives, such as the Washington state adaptation plan, may hold lessons for countries where adaptation is a central government responsibility, as well as for states in other federal countries. The United States' federal programme's approach to engagement with local and state governments – drawing on the roles of the Task Force, the USGCRP, federal agencies, and traditional federal agency stakeholders – shows how multiple avenues can be used to facilitate adaptation at other levels of government.

4. Lessons learnt

The review of national adaptation planning presented in this paper illustrates the range of different approaches to adaptation planning that OECD countries have taken. Within this range, this analysis distinguishes between adaptation strategies and adaptation plans (though countries do not always follow the same naming conventions as used in this analysis). Adaptation strategies are typically high level documents that set out overarching government approaches to adaptation. While the specific coverage within adaptation strategies varies across countries – including projected climate change impacts and vulnerabilities, possible adaptation options and policies, and evidence provision – they commonly serve to communicate the government's approach and commitment to adaptation to a wide audience and to facilitate national co-ordination of adaptation efforts. More than three quarters of OECD countries have published or are currently developing adaptation strategies.

Some of these countries have also moved beyond strategies and produced adaptation plans (as defined in this analysis). These plans set out concrete adaptation actions – for example, sectoral adaptation policies, adaptation projects and specific measures to address identified vulnerabilities. However, they vary both in how they are produced and the extent to which they specify responsibilities and timescales for implementation of adaptation actions. Some countries have taken a decentralised approach to producing their plans, where adaptation actions, timeframes and responsibilities for action are jointly agreed among key actors (in both the public and private sectors). Others have taken a more centralised approach that, while drawing heavily on stakeholder input, focuses on national government selection and prioritisation of actions and of the parties responsible for implementation. The extent of adaptation activities implemented, and the issues and challenges faced, vary depending on the approach countries take to adaptation planning – notably, countries which have developed adaptation plans are likely to face additional concerns compared to those which have developed adaptation strategies. Additionally, centralised adaptation plans will require more input from governments than decentralised plans, including specifying financial and technical responsibilities for adaptation measures.

There are several advantages to adaptation planning at the national level. National governments are able to take advantage of economies of scale in many aspects of adaptation planning, such as climate modelling, evidence provision and technical analysis of adaptation measures. The scale of their own operations means that national governments are important actors in their own right, when it comes to elements such as estate management and procurement. Outside of their own operations, national regulatory frameworks can affect the incentives and abilities of others to adapt to changes in the climate. Additionally, given that climate change is likely to have uneven impacts in countries – both geographically

and demographically – national-level planning enables governments to systematically consider equity concerns within existing policy frameworks or in specific adaptation policies. For example, governments can target adaptation efforts at particularly vulnerable sectors, regions or social groups.

The approaches taken by countries necessarily reflect individual contexts and needs. Countries with federal systems or strong localised decision-making processes, like Australia or Norway, have produced overarching strategies for adaptation that establish frameworks within which localised adaptation efforts can be implemented. In contrast, unitary states have the scope to produce national plans that outline specific adaptation policies and measures for different sectors or geographic areas. Some countries have also demonstrated that it is possible to undertake national planning without a national strategy. For example, national adaptation can be implemented through multiple sub-national adaptation strategies or through mainstreaming adaptation in existing national and sub-national policies and activities.

At the Policy Forum, officials from countries that have developed strategy documents were consistently positive about the decision to do so. Reasons for this are that formal adaptation planning documents can clarify and codify adaptation efforts, which are sometimes informal and unconnected. This allows for clear communication of roles and responsibilities (regardless of the specific roles envisioned for actors at national or sub-national levels or of the balance between public and private responses). Planning documents can also increase predictability by ensuring that the national approach to adaptation is understood by all those involved in adaptation decision making, and signal the government's degree of commitment to adaptation. As well as the benefits from the final product, the process itself of producing plans or strategies is useful in raising awareness of adaptation and creating links between relevant actors, both across government departments and with external stakeholders.

Drawing on countries' experiences at varying levels of adaptation planning, this section provides lessons learnt in terms of developing the evidence base on climate change, setting the strategic direction of adaptation plans and implementing programmes. The analysis draws on the OECD-wide survey of approaches in Section 2, the case studies, and discussion from the May 2012 *Policy Forum on Adaptation to Climate Change in OECD Countries*. Rather than attempting to provide an exhaustive overview of the issues, it focuses on some of the main issues identified by countries as being important.

4.1. Evidence provision

OECD countries have demonstrated significant advances in evidence gathering and in providing tools to assist end users in making use of increasingly sophisticated climate information. Nonetheless, policy makers have identified important unresolved issues: developing capacity for adaptation among key decision-makers, and reconciling the needs of users with the evidence that can feasibly be supplied.

Capacity for adaptation

Capacity development and the provision of climate change information are central in establishing enabling environments for adaptation, and are therefore a particular focus of adaptation strategies. However, adaptation planning also needs to include capacity building, both to support general actions and because plans give rise to additional, more targeted needs (such as sectoral or geographically localised climate impacts data, and capacity development for specific adaptation tools). The key message arising from this analysis relates primarily to general capacity development – investments in climate projections and impact assessments are necessary, but not sufficient for building capacity for adaptation among the public and private sectors (Pfenninger *et al.*, 2010; Swart *et al.*, 2009; Westerhoff *et al.*, 2011). Part of the challenge are the demands both for more sophisticated climate change projections and data, and that they be made easier for end users to apply. Progress on the former has been more rapid than on the latter.

More generally, there can be a mismatch between the types of climate information and data available and those required to meet policy makers' needs (Corfee-Morlot *et al.*, 2011; OECD, 2012b). This can be caused by a lack of communication between researchers and end users. Some countries have addressed this by creating "boundary organisations" to bridge the gap between producers and consumers of knowledge, such as the UKCIP in England. However, improved co-ordination is helpful but is not a panacea, because even with improved communication between consumers and producers, there are still underlying mismatches between the types of data that some users require and the data that it is currently feasible to provide. For example, it is currently very difficult to model the variations in micro-climates across mountainous regions, but understanding these variations is essential for disaster risk management.

The case studies provide examples of how countries have attempted to overcome capacity constraints as part of their adaptation planning. For example, Mexico has established a distance learning programme to enhance the capacity of sub-national level municipal staff. In the United States the White House CEQ issued guidance to United States federal departments to support their development of adaptation policy statements and departmental plans, while supportive working groups and a practitioner-level community of practice also facilitate information sharing and capacity development. The United Kingdom government's adaptation programme has supported the development of multiple tools to assist private actors' adaptation decision making, including the *Adaptation Wizard* and *Business Areas Climate Assessment Tool* developed under the UKCIP programme. However, despite these clear examples of measures to build capacity, there is still much more work to be done across OECD countries in applying a systematic approach to capacity development, both as a broader concept than just evidence provision and in terms of increasing the accessibility of climate data.

An additional important unresolved issue is the appropriate balance between public and private provision of climate information, and how to finance the former. Climate projections have the characteristics of public goods, and governments have often funded climate science activities and the provision of core climate data. However, this does not imply that the public sector should be responsible for supplying detailed climate data to all actors, especially given that the context-specific nature of adaptation means that it would be very resource intensive to provide all end users with information that is tailored to their particular circumstances. The private sector will therefore have a key role to play in providing these services, particularly for organisations where it would not be cost effective to develop the in-house capacity needed to produce or interpret this data themselves. In designing an evidence provision strategy it is important for countries to consider how public and private provision can co-exist and how the public sector can complement autonomous research, so as to avoid duplication or gaps in provision.

4.2. Strategic planning

OECD governments have taken a variety of approaches to setting the strategic direction of adaptation efforts. This variation extends to the processes of achieving national co-ordination, mechanisms for soliciting stakeholder input, structures adopted and approaches to prioritising measures. A clear lesson from these experiences is that a strategy document alone is not enough in itself to direct national adaptation – the structure and components of the document are important, and there also need to be effective mechanisms in place to implement the strategy.

National-level co-ordination

Improving the co-ordination of adaptation actions is a central aim of adaptation planning, although with important differences between plans and strategies in how this is achieved. Adaptation plans typically include greater detail on adaptation needs and measures, including responsibilities for different actions, as they need to effectively manage and co-ordinate different actors' tasks. While this poses logistical challenges, the specificity in adaptation plans makes it more straightforward to assign roles and co-ordinate

actions. In contrast, adaptation strategies have a different set of needs for co-ordination. As strategies tend to describe activities and objectives in broader terms, they need to include stronger general co-ordination mechanisms to achieve progress. A common approach taken in OECD countries – both for adaptation strategies and plans – has been to establish a central co-ordinating mechanism to oversee and direct adaptation. Co-ordinating units vary across countries in term of the parties involved, their remits and their powers – they include inter-ministerial committees, working groups, and task forces. Of the 24 OECD countries that have established co-ordinating units, 21 have been led by environment or climate change departments – the exceptions are Hungary, Norway and the United States.

In the context of developing countries, the OECD (2009) previously recommended that co-ordination be led by an executive office, in order to provide adaptation efforts with sufficient convening and leadership powers to effectively co-ordinate actions across departments or sectors. This conclusion was supported by the Independent Evaluation Group's assessment of the World Bank's interventions to support adaptation (IEG, 2012). The rationale being that in many countries the environment or climate change departments may be in a weaker position relative to other departments, such as planning or finance. These imbalances – both in terms of political power and funding – can create barriers to sustaining political support for adaptation across government. In turn, this can make it more difficult to maintain adaptation objectives in the long-term and to negotiate sustainable financial support over time within budget allocations.

However, an advantage of co-ordination by environment or climate change ministries is that they are likely to be the most aware of the technical requirements of national adaptation plans. For example, France found that relocating ONERC (the Observatoire National sur les Effets du Réchauffement Climatique, the body responsible for adaptation planning) from the prime minister's office to the environment ministry in 2007 helped it to address operational issues and to increase collaboration. Additionally, locating responsibility within a central ministry does not in itself guarantee long term political or financial support. It is likely to be a lower priority for central ministries themselves than it would be in a dedicated environment department, which can offset some of the benefits of being in a politically stronger ministry. The analysis of approaches taken in OECD countries did not find any relationship between the location of the co-ordination unit and the effectiveness of the programme.

An additional finding is that the existence of high-level formal structures, such as ministerial co-ordination groups, does not necessarily indicate the level of on-the-ground co-ordination. Given the recent implementation of many countries' national adaptation programmes, it may be too early to evaluate co-ordination groups' effectiveness beyond their initial success in convening representatives from different departments. However, the challenges that co-ordination mechanisms are intended to overcome – addressing cross-cutting issues and managing cross-departmental actions – require a firm grounding in adaptation policy. This issue is especially pertinent for countries with technical adaptation plans that specify required outcomes and measures for different departments and/or sectors. It is therefore valuable to complement high-level co-ordinating with working-level groups to provide technical direction. For example, the United States adaptation working group and practitioner-level community of practice support the higher-level co-ordinating efforts of the Interagency Climate Change Adaptation Task Force.

Stakeholder engagement

There is consensus amongst OECD countries that national adaptation planning should not be a purely technocratic process. Policy makers agree that it is vital to involve a broad set of stakeholders at strategic planning and policy design stages to assist the development of national programmes. As well as improving the quality of policy making, the process of stakeholder engagement is a useful mechanism for raising awareness and interest amongst key groups. A common feature of national adaptation planning has been the establishment of comprehensive consultation processes to solicit input from key stakeholders and the

general public. For example, Austria sought additional stakeholder input for its national planning through expert consultation, an extensive round of workshops with relevant organisations and internet-based engagement. However, at times governments have found it challenging to solicit input from the large number of potentially relevant stakeholders. Several countries have relied upon umbrella or intermediary organisations to facilitate the consultation process. The benefits of this approach are particularly marked when interacting with large, dispersed groups of stakeholders such as the general public or small businesses. The use of intermediary organisations has also been driven by pragmatism, as smaller stakeholders tend to have less capacity to engage with the process (Bauer, Feichtinger and Steurer, 2011). In the United Kingdom, the adaptation programme partnered with the Confederation of British Industry and the Trades Union Congress to solicit input from employers and employees, while also raising awareness and disseminating guidance.

Some OECD countries also face specific challenges in identifying and addressing the needs of indigenous groups. Indigenous groups, who often are already faced with significant social and economic challenges, are likely to be at particular risk due to climate change (IUCN, 2008; Galloway McLean *et al.*, 2009). Indigenous groups may also be less well included in traditional stakeholder engagement processes.[20] This means that there is a need to specifically engage with indigenous groups, despite the difficulty of doing so. One solution is to establish specific engagement procedures for indigenous groups, such as the United States EPA's policy statement and plan for consultation and co-ordination with Indian tribes (EPA, 2011). However, discussion at the OECD Adaptation Policy Forum highlighted that ensuring appropriate engagement and input from indigenous groups remains a key issue for OECD countries with indigenous populations.

Programme structure

In designing their national adaptation programmes, OECD countries have had to choose how to organise the delivery of adaptation actions – either mainstreamed within existing departmental portfolios or addressed thematically (e.g. "infrastructure" or "water"). Aligning adaptation to existing departmental responsibilities can help to ensure clear accountability for results, but at the risk of making cross-departmental interactions less frequent – for example, the interactions between land use planning and flood risk management. In principle these interactions should already be addressed by existing policy structures, but in practice this is often not the case. This can be particularly important during the development of plans or strategies, as adaptation needs can fall between traditional departmental operations or face overlapping or contradictory approaches from different departments (Bauer, Feichtinger and Steurer, 2011). While they may resonate less with policy makers, cross-cutting thematic approaches enable policy makers to deal with these critical interactions. This choice is important for setting the direction of both adaptation strategies and adaptation plans. However, the greater level of detail on actions and policies in adaptation plans requires a more thorough examination of organisational responsibilities and greater specificity on responsibilities for implementing actions.

The most common approach in OECD countries has been to combine elements of the two approaches in "sectoral" national programmes (though definitions of sectors are flexible and vary across countries). The federal approach in the United States has developed along departmental, regional and thematic lines: in 2012 federal agencies were required to develop agency-level adaptation plans; three national-level strategies that address cross-cutting issues (such as the management of freshwater resources) have been developed or are in the process of being developed; and there are a number of regional initiatives and partnerships. England's approach initially closely aligned adaptation roles to traditional ministerial responsibilities, with each individual government ministry responsible for developing Departmental

[20] For example, indigenous communities in Australia have noted that they feel excluded from government consultation exercises (Gardner, Parsons and Paxton, 2010).

Adaptation Plans. However, the forthcoming National Adaptation Plan will move towards a more thematic approach (Defra, 2012d). Mexico's Special Programme of Climate Change is based on a combination of departmental and thematic sectors, including a mix of economic sectors (e.g. 'agriculture, cattle, forestry and fisheries'), social concerns (e.g. 'health sector') and cross-cutting issues (e.g. 'land-use management and urban development' and 'disaster risk management'). A number of other OECD countries are also pursuing mixed sectoral approaches, including Chile, Korea, Poland and Turkey.

No matter which approach governments take – departmental, thematic or sectoral – co-ordinating activities within adaptation programmes poses a key challenge. As adaptation issues do not align neatly with departmental responsibilities, governments need to be proactive in taking action on cross-cutting issues. Under a thematic approach, governments have to co-ordinate measures across departments to ensure that thematic goals are met, generally using central co-ordination groups or mechanisms. In implementing these systems, there is scope to apply lessons from other fields of public policy that face similar co-ordination challenges. For example, there is a growing body of work in the water policy domain to address issues such as overlapping and unclear allocations of responsibilities, lack of institutional incentives for co-operation, mismatches between impact areas and administrative boundaries, and competition between different departments (OECD, 2011). Lessons learnt in other areas can be helpful in informing governments' approaches to climate adaptation.

Prioritisation

Selecting and prioritising adaptation options is a central part of adaptation planning. Governments need to identify the impacts likely to be most climatically and economically significant. They also need to prioritise specific issues or actions to ensure an efficient use of public resources. However, the difficulty of achieving this depends on the planning approach taken. In principle, adaptation strategies do not need to include prioritisation of either vulnerabilities or responses, as the key activities proposed in strategies (such as improving the evidence base, capacity building and mainstreaming adaptation within government activities) are largely invariant to the precise details of the climate change impacts. However, in practice adaptation strategies often include some prioritisation, in part to communicate important risks or vulnerable sectors. As adaptation plans include greater detail on specific activities and measures, they require a better understanding of key risks and of the options for addressing them. Prioritisation is therefore a critical component of adaptation plans, and needs to be more comprehensive and based on firmer technical foundations than in adaptation strategies.

Several promising approaches for prioritisation have been developed within OECD countries. The Swiss prioritisation system identifies key adaptation challenges within individual sectors. This approach uses three criteria – whether an issue is sensitive to climate change impacts, whether the impact is important relative to other impacts within the sector, and whether there is a need for action to address the issue – to produce an overall "importance" ranking, which feeds into the identification of action areas and key priorities in their strategy (OFEV, 2012). The United Kingdom government's prioritisation system draws on the CCRA, which enables the government to identify key climate change risks and to prioritise adaptation policy development both geographically and by sector. This process feeds into the adaptation planning process at a high level, so that policy development – both for the current programme and for the forthcoming National Adaptation Plan – is geared towards addressing identified critical issues. Governments have also identified criteria for choosing between individual adaptation policy options. For example, the Netherlands' national adaptation programme used a multi-criteria analysis approach to rank a wide range of adaptation policies according to five criteria: the importance of the policy; the urgency of the policy in terms of timing; whether it is a "no-regrets" policy; whether the policy has ancillary benefits for non-climate change policies; and what the policy's impact on mitigation policies is. Each criterion is weighted according to perceived importance to produce a weighted sum value for ranking policy options (Ministry of Housing, Spatial Planning and the Environment *et al.*, 2007; Ierland *et al.*, 2007).

There is noticeable variation in countries' prioritisation systems, including the choice of criteria, the level of importance attributed to each criterion, and the extent to which prioritisation is based on quantitative or qualitative inputs. Some of this variation is accounted for by different prioritisation needs for adaptation strategies versus those for adaptation plans. For instance, the issue of quantitative versus qualitative decision making is particularly salient for adaptation plans – a lack of sufficient or suitable projections of climate impacts was frequently cited at the Policy Forum as a key challenge for developing adaptation plans (OECD, 2012b). This poses less of a challenge for adaptation strategies, as they do not need to prioritise actions with as a high degree of specificity as is needed for adaptation plans. However, while a lack of climate impacts data is a challenge, it does not need to delay the development of national adaptation plans. The evidence base will never be perfect and the benefits of waiting for improved information must be balanced against the costs of delay. As with other areas of public policy, the challenge for policy makers is to make the best decisions given the available evidence.

4.3. Implementation

The overview of countries' progress in Section 2 suggests significant progress in implementing adaptation programmes since 2006. This section examines countries' implementation experiences in two specific areas – financing of adaptation and monitoring implementation. Box 2 provides examples of specific implementation approaches countries' have taken in the area of flood risk management, a critical issue in many national adaptation programmes.

Box 2. National flood management policies

Climate change is projected to exacerbate existing pressures on water systems, increasing both water scarcity issues and the risks of flooding. While climate change is just one factor which affects flood risk, it has reinforced the need to implement reforms of flood management policies. For several OECD countries, adjusting flood planning to take climate change into account has been a key component of national adaptation planning. These reforms and policies are crucial both due to the significant projected climate change flooding impacts, and because infrastructure to cope with flooding is long lived and therefore current designs and practices need to take climate change impacts into account to ensure continued flood protection.

Given the historic flooding vulnerabilities in the Netherlands, flood and water management are the major focus of their adaptation policies. Almost 40% of the adaptation options recommended by the Netherlands' national spatial adaptation research programme are in the water sector, more than double the number of measures identified for any other sector (Drunen, 2007). Historically, the Netherlands' approach to flood management has been to construct higher dykes and flood defences to cope with high discharges. However, since 2006 the Netherlands has pursued the alternative strategy of making "Room for the River" in response to the projected increases in discharges due to climate change (Room for the River Programme Directorate, 2012). The programme is led by the Ministry of Infrastructure and the Environment, in partnership with regional governments, municipalities and water boards, with a total budget of EUR 2.3 billion. The programme aims to increase the Dutch river delta's capacity to cope with increased flows by 2015 through a range of measures: lowering floodplains, deepening river beds, creating temporary water storage areas, relocating dykes to create wider floodplains, lowering groynes to increase river flow rates, creating high water channels, depoldering dykes, and removing obstacles in river beds (Room for the River Programme Directorate, 2012). Where it is not possible to increase the "Room for the River", the programme also plans for strengthening dykes.

The "Room for the River" programme has accompanied recommendations from the Dutch Delta Committee on managing climate change. The Committee, established in 2008 under the National Programme for Spatial Adaptation to Climate Change, was tasked with advising the Dutch government on protecting the coast and low-lying areas from climate change impacts. The Delta Committee produced twelve recommendations for the Netherlands as a whole and for specific regions. Its national recommendations included: increasing the flood protection level of all dyked areas ten-fold by 2050; only pursuing economically efficient development in low-lying flood-prone areas, with local areas responsible for the costs of local decisions; and requiring that new developments outside of dyked areas do not impede river discharge capacity or future water levels in lakes (Delta Committee, 2008).

In the United States, the federal system of government divides responsibility for managing flood risk among actors at different levels. Local actors are responsible for many decisions that affect flood risk, such as land use and zoning decisions, while the federal government plays a central role in national flood management through constructing flood control infrastructure (notably through the US Army Corps of Engineers), providing post-disaster aid and offering flood insurance (Carter, 2005). While climate change is expected to pose new challenges for federal flood risk management investments (US Army Engineer Institute for Water Resources, 2009), reforming the federal flood insurance programme has been recognised as a particular priority (Thomas and Leichenko, 2011). The National Flood Insurance Program (NFIP) has provided federal flood insurance to states, businesses and households since 1968, but faces serious challenges in continuing to provide insurance given growing socio-economic pressures and a changing climate. The most significant of these include: (i) technical challenges in producing flood maps as increasing flood risks bring new communities under the NFIP scheme; (ii) enforcing mandatory purchasing requirements as coverage is expanded; (iii) maintaining financial stability of the scheme under increased costs; and (iv) adjusting insurance rates to reflect actuarial risk and incentivise risk-reducing adaptation actions, while at the same time encouraging participation and keeping schemes equitable (GAO, 2007, 2010; Thomas and Leichenko, 2011).

In response to these financial and technical pressures on the NFIP, in July 2012 the United States Congress passed the *Biggert-Waters Flood Insurance Reform Act of 2012*. While not motivated specifically by climate change concerns, the act introduces a number of measures conducive to adapting the NFIP to climate change. It reduces the number of households eligible for subsidised insurance rates, requires actuarial standards to be used in setting insurance rates, doubles the maximum permissible annual rate increase, mandates the development of recommendations on incorporating future risks (including climatic changes and sea level rise) into assessments, and requires the incorporation of the future risk assessments into rate setting maps (United States Government, 2012). These reforms will help the NFIP to continue to provide flooding insurance in the face of climate change.

Financing the implementation of adaptation measures

The global costs of adaptation are projected to be in the order of tens to hundreds of billions of United States dollars per annum (Parry *et al.*, 2009). While costs will vary across countries, the scale of these estimates highlights the funding challenge that they will face in adapting to climate change. Securing financing for adaptation programmes is therefore a key concern for policy makers, and a key challenge to be addressed in adaptation programmes. As with other issues, policy makers will face different challenges at different stages of adaptation planning. Given their broad focus on improving the evidence base, building capacity and creating an enabling environment for adaptation, it is important that strategies identify sufficient funding for initial climate information and capacity building activities. Adaptation plans (especially centralised plans that set out specific actions and establish responsibilities for implementation) ought to be based on an understanding of measures' likely costs, to ensure they represent good value for money. Furthermore, as sufficient financing needs to be available during implementation to fund the planned measures, it is crucial that adaptation plans describe how they will be financed.

Many OECD countries do not specify how their adaptation programmes will be funded, or the scale of resources required for implementation. Some national programmes have considered funding of preliminary activities (such as vulnerability assessments and climate research programmes) and have estimated the costs of adaptation measures and identified some funding sources (such as pre-existing investments and actions that will contribute to adaptation goals), as in France's national adaptation plan. However, specific financing for adaptation measures has typically not been discussed in either strategies or plans. Mexico's Special Programme on Climate Change identified investment priority areas, but did not specify how such investments would be funded. England's adaptation programme has allocated some core funding for adaptation research, but has been designed on the basis that the funding of adaptation measures will be mainstreamed into ordinary budgetary channels. The United States' programme also does not specify how adaptation should be funded – it is left to individual departments to finance departmental adaptation policies. Among European OECD members, national adaptation strategies commonly do not specify how the implementation of adaptation programmes will be funded (Swart *et al.*, 2009).

A possible explanation for financing being omitted in national strategies is that countries may intend to increase their attention to financing as their planning efforts progress. Additionally, the focus on mainstreaming in both strategies and plans reduces the need to discuss specific funding mechanisms, as actions can be funded through existing departmental budgetary processes. Limited details on the actual costs of many adaptation options can also complicate discussions around financing needs and value for money (Biesbroek *et al.*, 2010). It is possible that financing may have been consciously omitted to enable development of adaptation plans – some participants at the Policy Forum suggested that it can be helpful to postpone financing decisions until after policy objectives have been agreed as explicit mention of costs can create barriers to discussion. Additionally, some national adaptation plans focus on enabling adaptation actions by other actors – such as sub-national governments and the private sector – and therefore have less need to identify national funding mechanisms. Participants at the Policy Forum also noted that, given the financial constraints across OECD governments, in some case the limited discussion of funding may be a reflection of the limited scale of public resources that are likely to be available.

Countries' experiences in implementing adaptation also suggest actions that can increase resource availability and maximise the impact of those resources that are available. Key options highlighted at the Policy Forum included building government support for adaptation by ensuring that adaptation aims are linked to current government priorities (notably economic growth), and by proposing adaptation options that serve multiple purposes and have multiple benefits (OECD, 2012b). Additionally, participants recommended adapting policy instruments or regulations that are already in place, rather than starting from scratch. These approaches can help governments to pursue adaptation goals at minimal additional expense.

Financial constraints have also encouraged governments to engage the private sector in adaptation. As a starting point, governments have encouraged the private sector to secure its own resilience to climate change (Agrawala *et al.*, 2011), which ought to reduce the need for public investments in adaptation. Beyond this, several government representatives at the Policy Forum stated that the public sector should consider how to attract private financing for adaptation investments. Private sector participants noted that significant levels of funding are potentially available if the levels of risk and return are appropriate. Governments are currently pursuing a range of approaches, such as loan guarantee schemes and public-private partnerships, to make these types of investments more attractive to private sector investors. The OECD recently developed a domestic policy framework for encouraging private sector investment in low-carbon and climate-resilient infrastructure, which brings together a number of policy elements for increasing returns and reducing risks (Corfee-Morlot *et al.*, 2012).

Monitoring and evaluation of national adaptation strategies

As countries implement adaptation programmes, they will also need to track the effectiveness of actions and the outcomes of adaptation interventions. The pressure for robust M&E varies according to the level of strategic direction countries provide, with a greater need to track the implementation of adaptation plans than the impact of adaptation strategies, due to increased activities and spending. At the same time, M&E could become more straightforward as countries implement adaptation plans – as plans are more specific about the measures and activities to be taken, it can be easier to assess progress on their implementation than it would be to judge the effectiveness of broader strategic efforts.

Relatively few OECD countries have developed detailed M&E approaches for their adaptation planning. In part, this is because many OECD countries are at relatively early stages of implementation of their adaptation programmes. Among the countries with more developed M&E approaches – Finland, France, Germany and the United Kingdom – a common characteristic of their frameworks is an initial focus on monitoring progress in creating the right enabling environment for adaptation (Swart *et al*., 2009). In essence, this entails a focus on monitoring processes (e.g. the number of government departments that have assessed their exposure to climate risks) rather than outcomes (e.g. reductions in vulnerability to climate change). However, regular monitoring must be complemented by longer-term evaluations that examine if set objectives have been achieved, whether they were the right objectives, and if the identified results can be attributed to the adaptation actions taken.

Participants at the Policy Forum noted the challenges involved in conducting M&E assessments, including generating baselines for use in assessing progress, attributing causality of outcomes to actions, the high costs of data gathering, and the long time horizons of climate change. Given these challenges, most countries are not yet in a position to evaluate the effectiveness of adaptation efforts using outcomes-based approaches. However, certain M&E approaches can help governments to address these issues. Notably, the United Kingdom's "preparedness ladder" allows policy makers to combine progress and outcome indicators, and should help in making the connection between adaptation policies and observed outcomes. The frequent snapshots of vulnerability provided by England's five-yearly CCRAs are expected to help policy makers assess progress and provide updated baselines against which adaptation interventions can be assessed. Vulnerability assessments such as these may give countries a means of assessing the broad effectiveness of adaptation programmes, as a complement to or in support of tracking the effectiveness of specific adaptation measures.

France's M&E strategy provides an alternative approach that can help to overcome technical and financial challenges to evaluation. The French approach combines comprehensive monitoring of the implementation of measures (using both process and outcome indicators) with targeted evaluation of key sectors using a range of evaluation techniques, such as impact assessment, cost-effectiveness and cost-benefit analysis. This pragmatic approach to evaluation – including a qualitative review of climate change

preparedness before and after adaptation interventions – is intended to enable the French government to review progress using existing tools and procedures. It should reduce the need to develop new technical evaluation techniques and the associated costs and challenges with gathering data.

While addressing political and technical challenges in the design and implementation of M&E approaches is critical, it also important to ensure that the results from M&E assessments feed into the development and evolution of national adaptation programmes. This requires both continuous learning (such as regularised assessments or periodic reviews) and feedback mechanisms that outline how M&E results (as well as new information) will contribute to ongoing planning and implementation processes (Pringle, 2011). To facilitate continuous learning and feedback into policy development, some OECD countries have provided a statutory basis for periodic reviews. For example, in the United Kingdom the 2008 Climate Change Act requires a review of the national adaptation programme every five years. In Finland, the national adaptation strategy underwent a mid-term review in 2009, with a more comprehensive review scheduled for the 2011-13 timeframe. Similarly, there will be a mid-term review of the French national adaptation plan in 2013, which will feed into the development of the next plan for 2015, and the Danish strategy will be revised before the completion of its implementation phase at the end of 2018, drawing on annual reports produced by a national co-ordination body (Swart *et al.*, 2009).

5. Concluding remarks

This paper has drawn on three strands of evidence – a survey of National Communications (NCs) to the UNFCCC, case studies and an expert workshop – to examine the current status of national adaptation planning across OECD member countries, and to bring out some of the lessons that have been learnt to date. Overall, there has been considerable activity since the previous OECD stock take in 2006. That analysis of NCs found that the focus was on discussion of projected climatic changes and the resulting impacts (Gagnon-Lebrun and Agrawala, 2006). There were some examples of standalone adaptation projects, but limited evidence of co-ordinated approaches being adopted. Since then, the majority of OECD countries have started the process of national planning for adaptation: 18 countries have implemented strategies or plans, and a further 8 are in the process of producing them. Some of the remaining countries have put in place systems for national co-ordination, as in the United States, or focused on enabling local and regional action, as in Canada, without articulating their strategies in a single document.

OECD countries have made significant investments in providing evidence and tools to inform the national planning process; for example, developing an increasingly sophisticated understanding of the potential risks of climate change, and a growing volume of work on identifying possible adaptation options. Several countries are now planning to go further than this in assessing the costs and benefits of adaptation options. These investments, and the prior decades of work they build upon, have proved a useful input into the policy-making process.

There has also been an increase in activity to facilitate co-ordination and mainstreaming across governments, and also between different levels of government. The common approach of structuring adaptation programmes sectorally (which includes a mix of departmentally-aligned work streams and cross-cutting issues) requires strong inter-departmental collaboration. Countries have often established specific mechanisms or groups to deliver this co-ordination, frequently led by environment ministries. National governments have also taken efforts to engage key stakeholders, including the private sector, in adaptation planning. It is important that the national adaptation planning process is a partnership, rather than something that is viewed as being imposed upon government departments and agencies, sub-national government bodies and private actors. An inclusive process of policy development can help deliver better policies, as well as building awareness and knowledge of adaptation.

The approaches taken have reflected national circumstances, but some common themes have emerged. The first is that the financing of adaptation actions remains an area where there has been limited discussion about where resources are going to be found, or even the likely scale of resource requirements. In part, this is because there is still a gap between high-level global estimates and localised studies. The second theme is that the development of sophisticated climate change data needs to go hand in hand with efforts to increase the capacity of end users to understand and apply these resources. There is also a risk of adaptation falling victim to "mainstreaming overload", as it becomes one of many cross-cutting priorities. Government actors may need support to enable them to develop the capacity to implement adaptation.

Finally, an area that has received relatively limited attention to date is assessing the results of the actions that have been implemented. Economic theory provides some indication of the types of approaches that are likely to be efficient or effective; for example, adopting a flexible approach and aiming for "win-wins" and "no- or low-regret options". However, there are different ways of achieving these objectives, and they will not be equally effective. Monitoring and evaluation (M&E) is important for political accountability, but also for learning lessons that can be used to inform revisions to the design of programmes. The limited attention to M&E partly reflects the high-level, strategic nature of many adaptation policies, where there is still more work to be done to specify the objectives and trade-offs in ways that are sufficiently detailed to enable assessments of progress. Even countries with plans specifying actions, responsibilities and timescales are at an early stage in their development of M&E strategies.

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ANNEX 1: GAGNON-LEBRUN AND AGRAWALA'S (2006) ANALYSIS OF NATIONAL COMMUNICATIONS

The table 'Coverage of impacts and adaptation in National Communications' in Gagnon-Lebrun and Agrawala's analysis *Progress on Adaptation to Climate Change in Developed Countries: An Analysis of Broad Trends* (2006) summarises selected European and OECD countries' progress in adaptation, based on their National Communications to the UNFCCC. Section A1.1 describes how the level of progress for each element was assessed. Section A1.2 sets out the sort of information included for each of the "elements of progress". These criteria apply both to the original 2006 analysis and to the updated analysis presented in this paper. Section A1.3 provides the original table as included in Gagnon-Lebrun and Agrawala (2006).

A1.1. Guidance for assessing scope and depth of discussion in National Communications

Two overlapping criteria were used to subjectively assess the coverage of each of the eight 'elements' in National Communications, which together give an indication of the ***scope*** and ***depth*** of discussion.

Coverage

The *scope* of the coverage was categorised qualitatively according to three possibilities:

a) 'Extensive discussion'

b) 'Some mention / limited discussion'

c) 'No mention or discussion'

Quality of discussion

For each element where some discussion was identified, the *depth* of coverage was categorised as either:

a) 'Discussed in detail' – For example, climate change scenarios are based on sectoral/national scenarios, vulnerability and/or impact assessments are conducted for more than one sector or ecosystem, discussion of adaptation options provides examples of policies implemented.

b) 'Discussed in generic terms' – For example, climate change scenarios are based on IPCC or regional assessments, vulnerability and impact assessments provide limited details, discussion of adaptation options provides no examples or only examples of planned measures as opposed to measures implemented.

c) 'Limited' – Limited information in National Communications, but references made to comprehensive national studies.

A1.2. Information assessed for each "element of progress"

Climate Change Impact Assessments

i) *Historic climatic trends* – Does the National Communication (NC) identify and/or discuss historic climate trends? Discussion should cover national trends, but may also include sub-national trends or higher-level / regional trends (where applicable to national contexts).

ii) *Climate change scenarios* – Does the NC discuss national level projections of future climate change? These include projected changes in temperature and precipitation (both absolute changes and changes in variability) and changes to seasonal patterns.

iii) *Impact and risks assessments* – Does the NC include assessments of impacts, risks and vulnerabilities arising due to climate change? These include both the current and future implications of climatic changes on vulnerabilities and impacts.

Adaptation options and policy responses

iv) *Identification of adaptation options* – Does the NC identify adaptation options? For example, climate proofing critical infrastructure, providing adequate flood defences, or planning for increased water scarcity and droughts. This could include proposed or potential measures and measures already implemented.

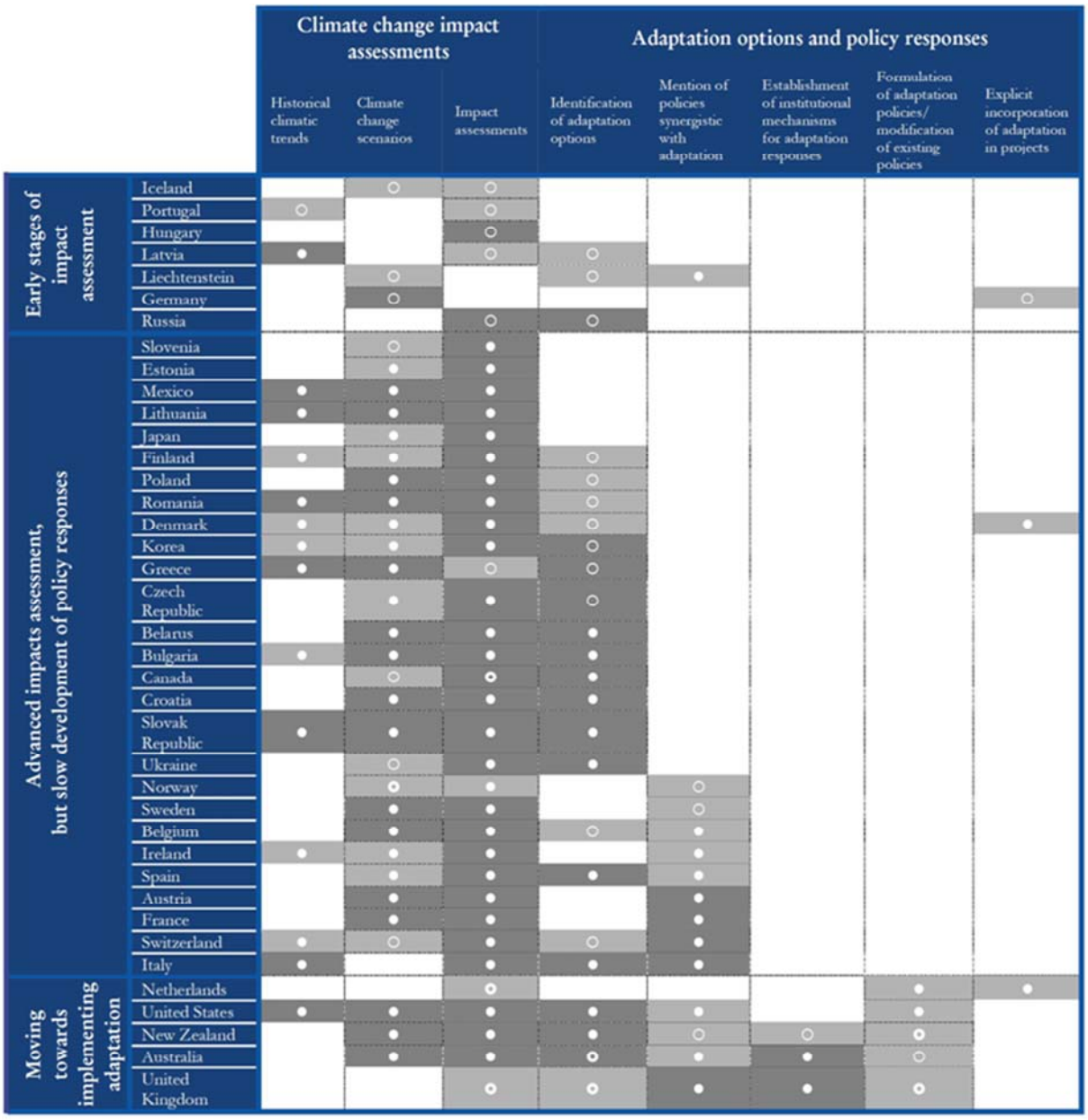
v) *Mention of existing policies synergistic with adaptation* – Does the NC discuss existing policies which might be synergistic with adaptation? Such policies may have been developed to deal with current climate variability, but may also be related, for example, to urban planning, natural hazards management, or biodiversity protection.

vi) *Establishment of institutional mechanisms for adaptation responses* – Does the NC identify the establishment of institutional mechanisms for guiding and implementing adaptation responses, as part of a national adaptation programme? For example, a co-ordinating mechanism for government-wide adaptation efforts, or a mechanism for developing and delivering adaptation strategies.

vii) *Formulation of adaptation policies / modification of existing policies* – Does the NC identify national policies for adapting to climate change, or does it discuss how existing policies will be modified to take adaptation into account? Such policies may include both centralised strategies for adaptation and strategies for implementing adaptation through regional or local government structures. This category also includes strategic modifications to existing policies as part of a national strategy.

viii) *Explicit incorporation of adaptation in projects* – Does the NC identify cases where adaptation has explicitly been incorporated into historic, ongoing or future projects? For example, incorporating adaptation into key infrastructure projects or other significant investment projects.

A1.3. 'Coverage of impacts and adaptation in National Communications'



Legend:

Coverage:

	Extensive discussion
	Some mention/ limited discussion
	No mention or discussion

Quality of discussion:

●	Discussed in detail, i.e. for more than one sector or ecosystem, and/or providing examples of policies implemented, and/or is based on sectoral/national scenarios
○	Discussed in generic terms, i.e. based on IPCC or regional assessments, and/or providing limited details/no examples/only examples of planned measures as opposed to measures implemented
⊙	Limited information in NCs, but references to comprehensive national studies

Source: Gagnon-Lebrun, F. and S. Agrawala (2006), *Progress on Adaptation to Climate Change in Developed Countries: An Analysis of Broad Trends*, OECD, Paris.