

Presentation

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1. Introduction

Climate change is one of the biggest challenges facing our societies. Many of the changes predicted by science are already evident and the Intergovernmental Panel on Climate Change (IPCC) in its special report 1.5°C Global Warming warned of the vulnerability of certain natural or human systems that could be severely affected even by small increases in the average temperature of the planet. In order to avoid intolerable risks, it is unavoidable and urgent to implement mitigation and adaptation policies over the coming decades (IPCC, 2018a).

Climate policy priority and efforts have long been directed at reducing emissions. However, we now know that adaptation to climate change is also essential. The Paris Agreement, approved in 2015 and which has been ratified by 189 countries, includes in Article 2 the double objective of reducing greenhouse gas (GHG) emissions to maintain the increase in global average temperature well below 2°C (and continue efforts to limit that increase to 1.5°C); and improve the resilience¹ and adaptive capacity of our society to face the impacts of climate change (UNFCCC, 2015). There has been a fundamental change in international negotiations, which recognizes the need to address both options, mitigation and adaptation, together (Magnan y Ribera, 2016).

The IPCC defines adaptation in human systems as the «process of adjusting to the current or expected climate and its effects, trying to moderate the damages or take advantage of the beneficial opportunities». As for natural systems, this refers to the «process of adjustment to the current climate and its effects; human intervention can facilitate adjustment to the expected climate and effects» (IPCC, 2018b). But in practice, what is adaptation?

Adaptation policies and measures can be very different in nature and can occur with different time and spatial scales; they can materialize through infrastructures and technical solutions, but also through laws, regulations or changes in behaviour.

¹ IPCC (2018b) defines resilience as the «capacity of social, economic and environmental systems to tackle dangerous events, trends or disturbances responding or reorganising so as to maintain their essential function, identity and structure, at the same time as retaining their adaptive, learning and transformation capacity».

Thus, it is possible to find various types of classifications that follow different criteria. Table 1 shows some of the most common examples. This is precisely one of the difficulties that must be faced when trying to measure progress in adaptation: a diversity of methods, metrics, scales and benchmarks (Ford *et al.*, 2015). But, as we will show in the third section, in addition to some important challenges, adaptation also presents a series of opportunities to move towards a more resilient society to climate change, more sustainable and just.

In the Basque Country, the first planning tool that specifically mentions adaptation to climate change among its objectives is the Second Environmental Program (PMA 2007-2010), although the Basque Environmental Strategy for Sustainable Development 2002-2020 (EAVDS) included in Goal 5 «limiting the influence on climate change». The Basque Climate Change Strategy Klima 2050 has two main objectives: the first is to reduce emissions² and the second is «to ensure the resilience of Basque territories to climate change». Adaptation has become increasingly important in Basque climate policy hand in hand with this strategy, which includes several goals and lines of action that address adaptation to climate change. The Basque Country's draft law on climate change also includes among its objectives the need to make progress in adapting to climate change and incorporates various measures to promote the deployment of adaptation policies in a transversal and intersectoral manner.

In the context of the European Green Deal, the European Commission announced a European Climate Law as well as a new, more ambitious European Climate Change Adaptation Strategy, whose background document is currently open to public consultation. In Spain, for the first time, adaptation has been included in the purpose of the draft Climate Change Law that has just been submitted to the Congress of Deputies. This bill highlights the importance of adaptation, the need to tackle it to avoid or mitigate the impacts of climate change and also highlights its economic and social benefits. Likewise, the National Climate Change Adaptation Plan (PNACC) is established as the reference document and basic planning tool to promote adaptation action.

This special issue study includes different aspects of adaptation to climate change, as explained in section 2. In section 3 we identify the main challenges and opportunities that it poses and in section 4 we briefly reflect on the potential effects of COVID -19 on adaptation policies. Finally, in section 5 we suggest some policy recommendations that we consider important to promote adaptation actions.

² The first objective is actually a double objective that aims to reduce GHG emissions by at least 40% by 2030 and 80% by 2050 (taking the base year 2005 as a reference) and to achieve renewable energy consumption by 2050 40% in relation to final consumption.

Table 1. EXAMPLES OF ADAPTATION MEASURES & CRITERIA FOR CLASSIFICATION

Criteria	Classification	Examples
Nature of the agents involved	Public or private adaptation	<ul style="list-style-type: none"> Public adaptation occurs when there is government intervention to support adaptation. For example, infrastructure construction or land development. Private adaptation occurs when the measures are implemented by private individuals or entities. For example, flood insurance.
Spatial scale	Local or general	<ul style="list-style-type: none"> Local adaptation refers to those options or measures implemented at a local (or regional) level, such as the construction of a certain protection infrastructure. Health plans dealing with weather-related conditions are examples of general adaptation.
Timescale	Short or long term measures	<ul style="list-style-type: none"> Short-term adaptation measures are those urgent measures to avoid or moderate climate change effects and current climate variability. For example, agricultural insurance. Long-term adaptation solutions reduce vulnerability and increase resilience to cope with the expected long-term impacts. For example, rising sea levels.
Type of measure	Infrastructure, behaviour, institutional or financial information	<ul style="list-style-type: none"> Infrastructures are constructions and technical solutions to tackle the impact of climate change. For example, land and urban planning, which incorporates climatic and resilience criteria. Behavioural options are those focused on changing common behaviours or practices, such as agricultural practices or methods. Institutional responses to climate change include policies, plans and other regulatory measures. Financial options include measures such as economic or fiscal incentives for adaptation. Information systems, such as early warning systems, provide data that can cope with certain impacts.
Capacity to respond when faced with uncertainty and/or tackle other associated benefits	No regret measures or low regret measures; win-win measures	<ul style="list-style-type: none"> No regret options (no regret) are those measures that represent net benefits even in the absence of climate change, such as the start-up of early alert systems; low regret measures are those that have relatively low costs and great benefits, such as improving efficiency in irrigation systems. Win-win or mutually beneficial measures, in addition to contributing to adaptation, also provide other social, economic or environmental benefits. For example, adaptation measures based on nature).

Source: Adapted from Sainz de Murieta et al. (2014).

2. Special issue contributions

This case study consists of ten articles that address adaptation to climate change from different perspectives.

Francesco Bosello and **Ramiro Parrado** present an introduction to the main methods for estimating the costs of climate change through macroeconomic models. They review different methodological approaches, analyse the differences between them and compare the main estimates they provide. **Alistair Hunt** and **Filippo Fraschini** describe the potential use of Portfolio Analysis for decision-making regarding adaptation to climate change. This methodology used in financial economics is currently underused in contexts of climate change, but its usefulness in contexts of uncertainty has an interesting potential.

In the field of climate finance, **Itziar Ruiz-Gauna**, **Ibon Galarraga** and **Patxi Greño** assess the impact of the sustainable bonds issued by the Basque Government in 2018 in terms of the direct effects of individual projects and their indirect impact on production, income and employment in the Autonomous Community of the Basque Country.

The energy sector, traditional and widely studied from an emission reduction perspective, will not, however, be exempt from suffering impacts as a consequence of climate change. **Giuliano Girardi**, **Jose Carlos Romero** and **Pedro Linares** analyse the direct and indirect impacts of climate change for this sector in Spain and incorporate recommendations at the international and state level. **Silvestre García de Jalón** explores the role that ecosystems, in this case forests and trees, can play in reducing atmospheric pollutants and estimates the economic value of this ecosystem service.

In relation to climate change and extreme weather events, **Luis M^a Abadie** and **Marek Smid** calculate the impact of heat waves in three Basque coastal capitals. The authors carry out a probabilistic modelling up to 2100 of the frequency, duration and intensity of heat waves considering two emission scenarios. For their part, **Pablo Martínez-Juarez**, **Sébastien Foudi**, **Ibon Galarraga**, **Nuria Osés-Eraso** and **Emilio Cerdá** review the methodologies for assessing damage associated with flooding, as well as evaluating adaptation measures for these phenomena.

Cities are gaining great importance and prominence in the fight against climate change. It is estimated that they are responsible for around 70% of global emissions and at the same time they concentrate a large part of the world population and economic assets, so it is expected that the impacts of climate change may cause significant human, economic and physical damage (Revi *et al.*, 2014). They are also active agents in climate policy. The portal for Global Climate Action (NAZCA³) promoted by the United Nations collects the actions of more than 10,000 cities that have made

³ NAZCA Platform: <https://climateaction.unfccc.int/>

their climate commitments public. **Marta Olazabal** and **María Ruiz de Gopegui** analyse the impacts for which 11 Spanish cities are preparing with adaptation plans. The authors identify seven main climate threats and also study how important aspects, such as uncertainty or cascading impacts, are incorporated into impact assessments in these cities. Urban planning is a fundamental planning tool, but it also represents a liability, an inheritance that conditions both the way in which we can face impacts through adaptation policies and also GHG emissions through certain preferences for transport.

David Heres and **Rafael Dávila-Bugarín** address, precisely, the relationship between planning and the use of different modes of transport, as well as their implications in terms of pollution and CO₂ emissions.

The final article in this case study does not analyse adaptation to climate change directly, although it does so indirectly. Adaptation is closely related to other global goals, such as halting biodiversity loss, disaster risk reduction or the 2030 Agenda for Sustainable Development. Of the 17 sustainable development goals (SDGs) approved by all the member states of the United Nations in 2015, number 13 is dedicated to «Climate Action» and its first goal seeks, precisely, «to strengthen resilience and capacity adaptation» to climate risks. In this context, **Álvaro de Juanes** and **José Miguel Giner** elaborate a synthetic indicator to measure the progress of 100 Spanish cities towards sustainable development.

3. Challenges and opportunities of adaptation to climate change

In this section we present the most important messages that have been extracted from the collaborations in this case study, which we complement with evidence from scientific literature on the adaptation to climate change.

3.1. Challenges of adaptation to climate change

One of the main challenges of adaptation, as the contributions to this case study show, is **uncertainty** (Bosello and Parrado). Decision making in contexts of great uncertainty makes it difficult to use traditional economic assessment methods such as Cost Benefit Analysis (CBA) and various authors have stressed the need to use alternative assessment tools (Fankhauser, 2017). An example is adaptive risk management, which consists of defining cycles for monitoring, analysis, review and learning for continuous improvement and adaptation of strategies over time (Jones *et al.*, 2014 and Martínez-Juarez *et al.*) Other economic tools include probabilistic risk analysis (Abadie and Smid), real options, or portfolio analysis, which Hunt and Franchini detail in their article for this case study.

Another adaptation challenge is that, although some changes are already evident, the main impacts will occur over a **long-term time horizon** (Bosello and Parrado). This implies the need to characterize our society in the future through socio-

economic scenarios (Martinez-Juarez *et al.*) However, the net present value of the costs of future climate change depends, to a large extent, on the discount rates used. Markanday *et al.* (2019) present a review of the existing debate regarding discount rates to be used in contexts of climate change. In any case, it seems reasonable to suggest that intergenerational equity criteria should be considered in long-term projects, in such a way that no generation prevails over others, which implies the use of lower discount rates than usual or, alternatively, discount rates, social discount that decreases over time (Groom, 2014).

The impacts of climate change have important **distributional effects** (Girardi, Romero and Linares). There are estimates that climate change could reconfigure the global economy, although not all countries will be affected to the same extent (Bosello and Parrado; Burke *et al.*, 2015). While globally the costs of climate change could reach between 1% and 3.3% of GDP, losses could be much greater in parts of Africa, Southeast Asia or India. However, it is important to understand that distributional effects do not only occur globally, but also in our European context (see, for example, Ciscar *et al.*, 2018) where the countries of southern Europe and those most vulnerable groups will be disproportionately affected by climate change.

Adaptation must also face a series of **barriers** or difficulties for its effective development (Olazabal and Ruiz de Gopegui). The scientific literature has approached the analysis of adaptation barriers from different perspectives and prolifically during the last two decades. Biesbroek *et al.* (2013) identify a large number of barriers in a literature review and classify them into five categories: institutional, social, informational, financial, and cognitive.

Finally, another of the adaptation challenges refers to **monitoring and measuring** progress (Olazabal and Ruiz de Gopegui). Currently the implementation of adaptation shows a relatively small deployment and existing adaptation plans incorporate numerous actions related to the generation of knowledge (Lesnikowski *et al.*, 2016). Adaptation presents a series of difficulties that do not occur in the case of mitigation, such as the existence of various definitions and metrics for adaptation (Ford and Berrang-Ford, 2016), in addition to the rest of the challenges mentioned in this section.

3.2. *Adaptation opportunities*

The main objective of climate policies is the reduction of emissions and climate stabilization (Markandya and Rübbelke, 2004), as well as increasing resilience and reducing vulnerability to climate change (Klein *et al.*, 2014), but many of these policies also generate additional or secondary benefits. The literature shows that additional climate policy benefits can be very important quantitatively, but considering these benefits also contributes to improving the acceptance of these policies (Longo *et al.*, 2012), overcoming scepticism and facilitating climate

action (Bain *et al.*, 2016). Co-benefits or side benefits are often ignored, although studies analysing these benefits have increased significantly over recent years.

The classic example of these secondary benefits is improved health as a consequence of emission reduction policies, which also lead to less air pollution (Heres and Dávila-Bugarín). However, and although they have been studied to a lesser extent, adaptation policies also offer **additional benefits and opportunities**, beyond avoiding or minimizing the damage caused by climate change (Olazabal and Ruiz de Gopegui).

Surminski and Tanner (2016) defined the triple dividend of resilience. The first dividend refers to reducing climate change damage, the second dividend seeks to harness the economic potential of adaptation, and the third focuses on economic, social and environmental co-benefits.

The **economic co-benefits** of adaptation are diverse, such as lowering baseline risk, which can help drive entrepreneurship and investment, and ultimately economic growth. Furthermore, adaptation can improve responsiveness to current climate variability without considering climate change, that is to say, reducing the adaptation deficit, as we saw earlier. Likewise, it represents an economic opportunity for the development of new goods and services (Klein *et al.*, 2014). Ruiz-Gauna *et al.* illustrate precisely how investment in sustainable bonds has contributed, indirectly, to production, income and employment in the Basque Country.

In the **social sphere**, the co-benefits of adaptation include examples related to human health, such as public health and emergency policies, measures that promote sustainable and healthy behaviours (Ebi *et al.*, 2013), the various benefits of green spaces in urban areas (Hartig *et al.*, 2014; Olazabal and Ruiz de Gopegui), or their contribution to sustainable development goals (de Juanes and Giner). Recent studies also address the importance of the contribution of adaptation to the construction of social capital, through the creation of networks and the strengthening of community and social interrelationships (Tanner *et al.*, 2016). Nature-based measures provide numerous examples of the potential **environmental co-benefits** of adaptation, such as green infrastructures for coastal or flood protection, watershed management options to ensure water availability, or protection and improvement of biodiversity. Furthermore, these benefits can be quantified and their monetary value can be assessed, as shown by García de Jalón.

The co-benefits of adaptation may also be especially relevant if we consider that its primary benefits (minimizing the impacts of climate change) are often only observed in the long term or in the case of probabilistic impacts, such as extreme weather events. Many of the co-benefits of adaptation, however, can be enjoyed in the short term and even in the absence of climate change (Tanner *et al.*, 2016).

4. Adaptation in the post-COVID society

At the time of writing this presentation the Basque society is phasing out lockdown and this may generate additional reflections, since one of the characteristics that adaptation and the post-pandemic situation share is uncertainty. It is still premature and perhaps daring to carry out exhaustive analyses of the implications that COVID-19 may have on climate policy in general, and adaptation in particular. However, as coordinators of this special issue we would like to share some thoughts. First, the pandemic seems to have awakened a sense of vulnerability, both individually and collectively, in our society as a whole. In this sense, we suggest exploring strategies that increase the **resilience** of our society to different situations (climatic or pandemic). Second, this crisis represents an **opportunity** for stimulus measures that are to be aligned with the necessary and urgent climate response. The United Nations (2020) has called for this opportunity to «build back better» once the pandemic has been overcome, borrowing a concept used in recovery contexts in post-disaster situations. A recent study by leading economists such as Joseph Stiglitz or Nicholas Stern, identifies a series of green stimulus policies with the potential to respond to the post-pandemic situation and the climate crisis, while also providing additional social and environmental co-benefits that contribute to reduce inequality. These policies are: (i) investments in infrastructure that they call «clean» (referring, for example, to the commitment to renewable energy); (ii) promotion of energy efficiency in buildings; (iii) investments in education and training to respond to unemployment in line with the needs of the transition to a low carbon economy; (iv) commitment to natural capital, to support the regeneration and resilience of ecosystems; (v) support for research and development (Hepburn *et al.*, 2020).

5. Policy recommendations

As we have seen, adaptation policies must face some challenges and at the same time represent an opportunity to move towards more resilient societies. The Basque Country has its 2050 Climate Change Strategy, which defines as strategic objectives the reduction of emissions and deployment of renewable energy and guaranteeing the resilience of our territory to climate change (Basque Government, 2015). Below, some actions are suggested that may be additional or complementary to those proposed in the 2050 Climate Change Strategy.

a. *Better understand the potential impacts of climate change*

There are some impacts for which there is still insufficient information, for example, those related to water resources, transport or biodiversity. In relation to economic costs, there are some studies in the Basque Country that address certain impacts, usually related to extreme events such as floods (Osés-Eraso, 2009), but it would be desirable to have a more complete perspective of the various sectors, with

interrelationships between them, including estimates of the Basque economy in terms of the impact on GDP or employment.

In addition, and as global temperatures continue to rise, it would be important to explore the impact of low-probability high-damage events and possible tipping points that could affect the Basque Country, not only climatic (Kopp *et al.*, 2016) but also socioeconomic events (see, for example, van Ginkel *et al.*, 2019).

b. *Identify the opportunities, costs and benefits of adaptation in the Basque Country*

Although this point has been addressed in a general way in this presentation (a more detailed review can be seen in Sainz de Murieta, 2019), it is important to assess specifically how to exploit adaptation opportunities in the Basque Country, as well as the co-benefits. There is ample evidence that the direct benefits of adaptation, in terms of avoided damage, often far outweigh its costs (see, for example, Abadie *et al.*, 2020, which includes estimates for Bilbao and Donostia-San Sebastián). Knowing this relationship between the costs and benefits of adaptation, even in uncertain contexts, could give an important boost to its planning and implementation.

Risk affects and is perceived differently by different actors, since they may present diverse exposures, vulnerabilities, attitudes and capacities to face the risks of climate change. As a result, risk preferences are highly dependent on social, cultural, and economic contexts. In this sense, considering social and behavioural aspects is also of great relevance for adaptation.

c. *Identify and implement the necessary tools to support adaptation*

In general, governments are making a limited deployment of tools for adaptation. In a survey carried out through the Regions4 network in various regional governments, they indicated that the most common tools in adaptation contexts, both at regional and state levels, were climate change programmes, information and training measures, and regulation frameworks, although even these did not exist in most regions (RegionsAdapt, 2019). Plans and programmes are the most widespread tools, even though a study of 885 European cities showed that only 26% had an adaptation plan, compared to 66% that had mitigation plans (Reckien *et al.*, 2018). In Spain, only 11 provincial capitals have an adaptation plan (Sainz de Murieta *et al.*, 2020).

Approval of the draft law on climate change in Spain can be an important milestone to promote adaptation policies in the State, whose development through the PNACC should include the periodic assessment of climate change impacts, vulnerability and risks, the definition indicators and periodic monitoring or the need to involve agents in the adaptation processes. The approval of a law of its own that gives a boost to adaptation in the specific context of the Basque Country, following the

example of other regional governments such as Scotland, would also be an important measure to reinforce the implementation of climate change adaptation.

d. Establish coordination mechanisms between adaptation and mitigation policies

Although mitigation and adaptation policies are very different in nature and are usually coordinated even from different departments, it is important to explore the interrelationships and synergies between them. First, we must not forget that achieving greater GHG reductions globally will translate into minor impacts and therefore a lesser need for adaptation. Second, the design of tools that can favour the implementation of both types of policies could also be explored. Lastly, coordination mechanisms could also avoid cases of maladaptation, which are those actions defined to reduce impacts or vulnerability to climate change that increase the vulnerability of other systems, sectors or social groups (Barnett and O'Neill, 2010). Although there are different types of maladaptation, in this case we would be talking about adaptation measures that increase emissions. The classic example is the use of air conditioning to cope with extreme heat.

e. Incorporate distributive criteria, gender, equity and justice

There are important **distributional effects** to consider when evaluating the impacts of climate change. Impoverished countries will suffer more from these effects, as will women and the most disadvantaged and vulnerable groups. Regarding the **gender perspective**, member countries of the United Nations Framework Convention on Climate Change approved a Gender Action Plan at the summit held in December 2019 in Madrid, a milestone that recognizes the importance of considering not only the uneven impacts of climate change on women and girls, but also the need for adaptation to incorporate measures to ensure equality. Although these aspects have been included in the literature, especially on impacts, in practice we can observe that integration into adaptation plans and programmes is still limited. This is, however, a key issue to achieve a more progressive and, ultimately, just distribution of resources (Watkiss and Cimato, 2016).

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