Implementation of climate change adaptation measures with a focus on Portugal

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(references used in this article are embedded in the text as hyperlinks)

The anthropogenic climate change has already led to increased frequency and intensity of climate and weather extremes including hot extremes, heavy precipitation events, droughts, and fire weather resulting in pervasive impacts on ecosystems, people, settlements, and infrastructure. Beyond 2040 and depending on the level of global warming, we will experience numerous risks to natural and human systems. For the 127 identified key risks impacts are expected to be multiple times higher compared to today (IPCC, 2022).

To reduce the impacts, climate change adaptation measures need to be implemented. Those have the common goal to protect nature, people, and

livelihoods against the expected impacts of climate change (Dessler, 2021). Adaptation includes a great variety of actions concerning land and ocean ecosystems, urban and infrastructure systems, energy systems, as well as cross-sectoral actions. These actions should be conceived in combination with mitigation actions as well as the relation to the sustainable development goals resulting in overall climate-resilient development (IPCC, 2022). For the scope of this article, I will however solely look at the implementation of adaptation measures in the European Union with a special focus on southern Europe.

The large-scale, big-cost, and long-timeframe nature of adaptation measures highlight the need for an adequate governmental and institutional framework (Vink et al., 2013). The local governance arrangements especially hold a key role in adaptation because of their public functions, such as land use regulation, infrastructure protection, inspection, as well as emergency planning. Furthermore, the integration of stakeholders, communities and other local actors is key to place-based knowledge and thereby helps to decrease local vulnerabilities through customized adaptation actions (Aguiar et al., 2018). In its latest version of the strategy for adaptation to climate change, the European Commission emphasized the importance of the local level as well as the potential of transfer of local solutions on a cross-border scale (European Commission, 2021).

However, the implementation of adaptation measures is not happening in isolation on the local level. Instead, these actions require complex interactions across multiple scales of governance, which can lead to barriers to implementation. These can be caused by a lack of collaboration, lack of coordination, a divergence of priorities, or political opposition (Fares, 2021). Furthermore, the large timescale of climate change can pose challenges for local policymakers. The disparity between up-front investments and possible benefits only becoming tangible in the future can lead to policy-makers assigning the issues a low priority (Aguiar et al., 2018). To successfully implement adaptation measures the mentioned challenges must be overcome. In the following, I will cover how European countries have implemented adaptation measures.

The EU strategy on adaptation to climate change sets out 3 principal objectives for smarter, faster, and more systemic adaptation. Through these, the EU aims to improve the adaptation actions of its member states (European Commission, 2021). The implementation of adaptation measures is in most cases done by local

actors. Therefore, to assess the implementation, it is necessary to look at the local adaptation strategies. Aguiar et al., therefore, analysed 147 local adaptation strategies in Europe. They found big disparities in the number of local adaptation strategies of different countries. Of the 147 analysed strategies, 28 belonged to Portugal and 21 to Germany, while Spain only accounted for seven strategies. This difference also continues to the spatial focus of the strategies. While Portugal developed strategies for large, urban municipalities as well as for smaller rural municipalities, other countries such as France have strategies mainly developed by urban areas. The vulnerabilities which the strategies aim to mitigate also vary between northern, eastern, western, and southern Europe. Strategies in northern Europe target flooding more often compared to the other regions. Strategies in southern Europe meanwhile put an emphasis on extreme temperatures and soil erosion/ landslides. This resulted in more strategies aimed at agriculture in southern Europe (Aguiar et al., 2018). According to Bindi and Olsen, the higher vulnerability of agriculture in southern Europe can be explained by an increased chance of water shortages and extreme climatic events in the future (Bindi and Olsen, 2011).

In the following, I will focus on the climate change vulnerabilities and associated adaptation measures in Portugal. While Portugal is one of the European countries most vulnerable to the impacts of climate change, the specific vulnerability varies regionally. The coastal areas are most vulnerable to sea-level rise and flooding. Southern areas and the hinterland are mostly affected by desertification and drought; however temperature increases, heat, cold waves, frequent and intense extreme weather events, and fires potentially affect the entire territory (Carvalho et al., 2014). In 2019 the Portuguese government adopted its first national adaptation strategy. This strategy aims to improve the level of knowledge on climate change, promote the integration of climate adaptation in the various public policies and operationalization of instruments, placing greater emphasis on the implementation of adaptation measures (Climate-ADAPT, 2022). However, before 2019 there were also adaptation actions on the local or regional level addressing different vulnerabilities (BASE, 2016). Emerging from grants by the European Economic Area and the Portuguese Government between 2014 to 2016, ClimAdaPT.Local aimed to initiate local adaptation strategies on a municipal level. One municipality was chosen for each of the inter-municipal communities. The process was intended to set up a broad governance framework involving a diverse group of community stakeholders, thereby gaining access to local knowledge. It

was also intended to engage the local communities and thereby increase the local adaptation knowledge, helping to identify adaptation priorities, promote a common understanding of vulnerabilities as well as adaptation, and encourage the sharing of adaptation responsibilities. Overall, the involvement of the local community was supposed to create synergies and thereby increase the adaptation efficiency. The program consisted of three basic steps, which were adapted to the local conditions and involved actors. The first step was to draft a scenario of the current and future vulnerabilities specific to each municipality. The second step was to examine the risks and priorities related to the expected impacts of climate change. In the last steps, the actors came together to develop several custom adaptation options.

Mourato et al. (2018) concluded that the program was effective in establishing or enhancing local participation in adaptation action. Through the active participation and the overall framework of the program, a top-down strategy was avoided. This should enable greater identification and thereby acceptance of the adaptation measures by the local communities. They also identified the strengthening of local institutions regarding climate change knowledge. The process equipped them with the necessary tool to manage adaptation issues (Mourato et al., 2018). However, it should be noted, that the long-term impacts of the program are yet to be assessed. The role model character of the chosen municipalities on the neighbouring ones is especially vital for a nationwide implementation of local adaptation strategies. At this stage, ideally the national, as well as the European adaptation strategy, provides the necessary framework.