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Ensuring just resilience to climate impacts: a framework for policy implementation*

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Abstract

Just resilience is a conceptual framework to guide equitable, persistent and transformative adaptation to climate change impacts, ensuring that systems are robust and can shift when previous equilibria become unsustainable. Much research exists to define this concept, with much less instruction on how to incorporate these key principles into policy decision-making. In particular, much emphasis exists to consider the definition and application of concepts for countries categorised as being low and middle income economies, with less guidance for high income countries. This paper provides this insight, focussing on Ireland as a representative case study. We collate findings from the literature to provide a comprehensive definition and framework through which principles of use may be incorporated into the policy formulation process.

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1 Introduction

Human-induced climate change causes adverse impacts and losses to both nature and people, beyond natural climate variability (IPCC, 2023). More frequent and intense extreme events are among the most salient shifts that require adaptation by social and economic systems. A considerable shift in social and economic processes is required to both mitigate and adapt (Climate Change Committee, 2022; European Commission, 2021; Department of the Environment, Climate and Communications, 2018) to these effects, resulting in second-order social and economic consequences (Naylor et al., 2019) Khan et al. (2021)Abbas et al. (2023). Ensuring that adaptation to these shifting effects on societal welfare is distributed equitably, both in terms of costs and benefits, is an important facet of the policy decision-making process. This has been encapsulated by the concept of 'just resilience'.

Focussing on societal justice, this paper considers the factors of importance for policymakers in high income economies when designing a just resilience strategy, providing guidelines for incorporation into decision-making processes. Wang and Lo (2021) provide a review and categorisation of the various conceptualisations; McCauley and Heffron (2018) unite both climate and energy strands of the just transition into a unified conceptualisation; while Healy and Barry (2017) consider the political economy considerations of the just transition. Much national-level guidance exists. In an Irish context, for instance, The National Economic and Social Council (2021) provide insight into the appropriate definition of just resilience for Irish urban centres. This paper addresses a gap in the understanding of the policy measures that may be put in place, exploring just resilience through the lens of policy decision-making, and identifying facets of this concept that are important in this regard. We subsequently translate this into a framework to incorporate measures into the policy design process.

The consideration of just resilience is particularly important for localised decision-making, as the impacts of climate change, and the vulnerable populations exposed, are spatially heterogeneous. Climate impacts vary by location, alongside social and economic conditions. It is the coincidence of particular climate events with vulnerable population cohorts that results in a particular vulnerability to climate change (European Commission, 2022). In warmer climates, lower income groups are often more exposed to heat stress, whilst lower income groups are often more exposed to cold weather extremes, alongside the effects of flooding and storms, in more temperate climates (European Environmental Agency, 2018). While much policy and research literature (e.g. European Environmental Agency, 2018) considers such vulnerability in an international context, intranational heterogeneity

in exposure is of importance for national-level decision-making. Identified by sources such as the European Climate and Health Observatory (2022) and Ceolotto and Farrell (2023), many local administrative units with higher unemployment rates tend to have larger areas at risk of flooding. Indeed, there is often a strong correlation between the residential location of some vulnerable cohorts and flood risk (e.g. Filcak, 2012), whilst the housing market may result in certain less well-off cohorts to areas of higher flood risk (European Environmental Agency, 2022).

To illustrate, it may be useful to consider the policy response in our case study, Ireland. A number of assessments of climate vulnerabilities particular to Ireland have been made. The Northern and Western Regional Assembly's Regional Economic and Spatial Strategy (RSES) identified a number of climate risks that are most important in an Irish context, including a rise in sea levels, changes in rainfall events, increased frequency of storm events, changes to air and soil temperature and periods of increased drought (Northern and Western Regional Assembly, 2020). As the most prevalent risks in an Irish context, this paper considers the incorporation of these risks into climate adaptation policy decision-making. There exists some research in the public domain which incorporates elements of a definition of just resilience in an Irish context. Most notably, The National Economic and Social Council (2021) consider just resilience in an urban setting. To differentiate from this and similar research, this paper takes a policy focus, identifying what measures of just resilience are important for policy decision-making and how best to incorporate into policy processes. To this end, we present a framework which policy may adopt to ensure measures of just resilience are adequately captured by decision-making.

To understand these factors, we must first discuss the conceptualisation of resilience in an ecological setting. Pioneered by Holling (1966, 1973), this was first framed as "the magnitude of [a] disturbance that can be absorbed before [a] system changes its structure". Where the general conceptualisation of resilience in an engineering sense focuses on the ability and speed to bounce back from a perturbation,[1] the interpretation in an ecological sense reflects the ability to sustain perturbations and for the ecological system to remain within critical thresholds (Davoudi et al., 2012). This view has evolved, especially in its application to social sciences and complex social-ecological systems, to include an element of transformation (Davoudi, 2018; Pieraccini, 2019). Without the consideration of transformation, the concept of resilience - a concept which describes the ability of a system to return to a previous state - opens up the possibility of a return to a previous yet undesirable

[1]Resilience in the engineering sense takes a connotation of stability and persistence: the ability to withstand external shocks and return to a state of equilibrium (Davoudi, 2018); two key factors in such a measure of resilience are the degree of resistance to disturbances and the speed to revert to equilibrium (Davoudi et al., 2012).

state. For instance, the application of unadjusted resilience to a subsistence economy in a 'low-level equilibrium trap' suggests that it is desirable to return to the subsistence level of consumption upon being affected by a perturbation (Nelson, 1956). The incorporation of transformation considers the human ability to displace disturbances over time (across generations) and space (across borders) (Davoudi et al., 2012; Davoudi, 2018). An augmentation to incorporate transformation allows for a shift when a previous equilibrium becomes undesirable or unsustainable (Davoudi, 2018; Pieraccini, 2019). This is particularly relevant in the context of climate change, where a changing set of climatic conditions requires a transformation of social and/or economic processes to settle at a sustainable equilibrium.

The concept of just resilience may be considered in two contexts; distributive and procedural justice. Distributive justice reflects the way in which climate impacts are distributed across society. Depending on the trajectory of climate change, and the trajectory of associated policy interventions, the distribution of benefits and costs can have different effects for different regions, economic sectors and socioeconomic groups. There is potential for the distribution of burdens and benefits to be allocated in unequal and undesirable ways (Breil et al., 2021). It is therefore essential to take into consideration the concepts of justice and equity in the design and implementation of climate adaptation measures such that the resulting distribution of effects is equitable. Procedural justice, on the other hand, is preoccupied with the equity and transparency of decision-making processes. It posits that a decision-making process should incorporate all relevant groups; that they are recognised and allowed to participate; and that there is a balanced distribution of influence (see, among others, Tyler et al., 1997; Young, 2002; Fraser, 2001). Much research contained within the literature on law and resilience suggests that there is a causal link between distributive justice and procedural justice, such that the former is not attainable without the latter (Fraser, 1997; Young, 2002; Schlosberg, 2007; Pieraccini, 2019). As such, it is of imperative importance that policy decision-making reflects procedural justice and, in so doing, distributive justice is often a self-reinforcing outcome.

The paper provides a comprehensive review of the literature on equity, justice, and resilience, collating principles important for climate policy decision-making, both in terms of procedural and distributive justice. In doing so, this paper proceeds as follows. Section 2 reviews the definitions of equitable decarbonisation and just resilience contained within the literature, identifying the factors that one must consider when designing policy for just resilience.

2 A definition of just resilience for policy decision-making

The concept of just resilience can influence both the inputs to policy decision making (i.e. 'procedural justice') and their outputs (i.e. 'distributive justice'). Each of these concepts will now be reviewed in full.

2.1 Procedural justice

Procedural justice is preoccupied with the equity and transparency of decision-making processes. It suggests that a decision-making process should incorporate all relevant stakeholder groups; that they are recognised and allowed to participate; and that there is a balanced distribution of influence (see, among others, Tyler et al., 1997; Young, 2002; Fraser, 2001). Only when all those affected by the impacts of a decision are included in the decision-making process and have the power to influence the outcome can the decision be considered legitimate (Young, 2002). Much research contained within the literature on law and resilience suggests that there is a causal link between distributive justice and procedural justice, such that the former is not attainable without the latter (Fraser, 1997; Young, 2002; Schlosberg, 2007; Pieraccini, 2019).

The role of procedural justice has evolved. Early resilience scholars viewed participation from an instrumental perspective, as a means to improve knowledge, build trust and, in turn, legitimacy of decision-making (Olsson et al., 2004). Yet, to ensure procedural justice, the attention should be placed on which interests are represented, by whom, why (Pieraccini, 2019) and how. This means, for example, including new constituencies in the discourse as well as ensuring that vulnerable groups are not just present, but are allowed to understand and actively take part in the decision-making process (Young, 2002; Davoudi, 2018).

It has been noted in the literature that more disadvantaged groups are less likely to either be included in the discussions (maybe because they have different priorities which are not fully understood by planners and decision-makers), or to effectively express their opinion (for example due to information or procedural barriers; Breil et al. (2021)). It has been noted that a lack of recognition can lead to marginalization, an inability to share their knowledge to inform adaptation policies and, in turn, may be less likely to receive the benefit from said policies (Breil et al., 2021). This can become cyclic, whereby marginalization creates obstacles to achieve recognition and participation in decision-making processes, which then furthers said marginalisation (Young, 2002).

The first step therefore towards procedural justice is then to ensure a wide inclusion of vulnerable

constituencies in the decision-making process (Pieraccini, 2019). This aids external inclusion (Young, 2002), the incorporation of all relevant stakeholders in the decision-making process. External exclusion has been defined as the inability for a stakeholder to express their view, or for said view to be systematically ignored (Davoudi, 2018; Sultana, 2022; Markkanen and Anger-Kraavi, 2019; Reckien et al., 2018a). Various solutions have been proposed to address the challenges associated with climate change adaptation. These solutions emphasize empowering local communities in decision-making processes. Amorim-Maia et al. (2023), Wardekker et al. (2010) and MacArthur (2015) advocate for Institutional Change for Resilience, which refers to the change in structures, policies and practices of institutions, overcoming challenges of exclusion, like using quotas for certain context-specific groups. Folke (2006) underscore the need for collaboration between research, industry, and government. A critical aspect of effective adaptation involves ensuring the meaningful involvement of all people in both decision-making and implementation processes. Agyeman and Evans (2003) and Coggins et al. (2021) add to this by stressing the importance of the equitable distribution of outcomes.

While these factors can help to remedy 'external exclusion', it does not necessarily guard against 'internal exclusion' (Young, 2002). Internal exclusion considers the fact that neither inclusiveness nor participation alone guarantee representation and therefore procedural justice. Measures may therefore be required not only to include the more disadvantaged groups in the political discourse and decision-making process, but also to ensure that they have easy access to information and meetings, that they understand the issue at hand, that their voice is heard and given the same weight as other groups (Breil et al., 2021).

2.2 Distributive justice

Distributive justice in the context of climate change pertains to the equitable distribution of both costs and benefits of climate inducing and adaptive activity (Caney, 2005; Konow, 2003). In an international context, it embodies the principle that countries that have accumulated wealth through carbon emission bear the greatest responsibility for mitigation and international adaptation (King and Harrington, 2018; Martin, 2015). At a sub-national level, distributive justice often entails the consideration of which groups are most vulnerable to the negative impacts of climate change and associated policies. Designing policies such that impacts do not exacerbate existing inequalities is a central facet of distributive justice (Paavola and Adger, 2002a; Schlosberg, 2012; Coggins et al., 2021; Amorim-Maia et al., 2022). To this end, Sovacool et al. (2015) consider the concept of 'leaving nobody behind', whereby climate change policy should focus on the needs of the vulnerable without

disregarding other segments of society.

Much research exists to identify the socioeconomic cohorts most negatively affected by climate change impacts and mitigation policies, such that they may be targetted by any remedial policy to ensure distributive justice. Equitable adaptation policy may be formulated once the mechanisms that generate inequitable outcomes are effectively understood (Sovacool et al., 2015). A number of socioeconomic factors have been identified in the literature. These include low income (Greenstein et al., 2008; Haque et al., 2014; Ballew et al., 2020); marginalised communities (Adger, 2000); and limited access to resources like education (O'Neill et al., 2020; Ballew et al., 2020), healthcare, and social services (Oven et al., 2012). All of these factors hinder the ability to cope and adapt to challenges posed by climate change. Communities heavily dependent on agriculture have been found to be more vulnerable to climate change as are those in low-lying coastal regions (Broto et al., 2015), effects that have been identified as being of important in an Irish context (Northern and Western Regional Assembly, 2020). In addition, inadequate infrastructure and information - such as poor housing, transportation, and communication systems - are associated with populations who are less equipped to recover from climate-related events (Chinowsky et al., 2015; Oven et al., 2012).

Together, these factors comprise a concept of social vulnerability. Breil et al. (2018), following Parry et al. (2007) and Lindley et al. (2011), define social vulnerability as 'a state resulting from [the] interaction of socio-economic and environmental characteristics, such as personal sensitivity, economic deprivation or housing conditions, affecting how prone [a community may be] to harm from climate-related events'. It comprises three main components. 'Sensitivity' includes factors that can drive or increase vulnerability such as age or physical and mental conditions. 'Enhanced exposure' relates to socio-geographic conditions that can exacerbate climate impacts, such as the lack of green spaces or of adequate water management and drainage systems. 'Adaptive capacity' results from the combination of the ability to prepare, respond and recover. Such adaptive capacity may be drawn from education, income, or access to public services (Lindley et al., 2011).

Much research has extended their analysis of vulnerabilities to consider concepts of livelihood and economic basis for survival. Additional vulnerable groups that fall under this category include those at risk of losing their livelihood, culture, well-being, and health due to the changing environmental conditions (Atteridge and Remling, 2018; Young, 2002), individuals with poor health and mental conditions, or those working in activities more subject to climate impacts, such as agriculture and tourism (Breil et al., 2021).

In a climate change adaptation perspective, social vulnerability relates to both climate impacts

as well as adaptation responses. In the first case, the focus is on the distributive aspects of climate change impacts, which can vary substantially across nations (Breil et al., 2021), regions or even within the same community, based on geographic characteristics (Meyer-Abich, 1990, 1997) (e.g. territory conformation), socio-economic characteristics (e.g. quality of services, responsiveness of local authorities, households' financial means), and demographic characteristics (e.g. age composition (Stern, 2006; Thompson, 2010), physical and health conditions (Breil et al., 2018)). The second relates to distributive and procedural aspects of the measures to deal with those impacts and describes the fact that, while such measures are designed to address certain social vulnerabilities (Schlosberg, 2007; Fraser, 1997), they also have the potential to affect or create other ones. This complex relation lies at the heart of the idea of just resilience (Nalau et al., 2015).

2.3 Principles of application

Work by authors such as Breil et al. (2021) have identified principles which may guide the incorporation of just resilience principles in the application of climate adaptation. In light of the discussion presented so far, it is possible to outline some key principles that characterize just resilience for climate change adaptation.

- *Principle 1.* Just resilience policies are designed to protect vulnerable cohorts. It is fundamental that policy-makers have a clear understanding of (i) the concept of resilience, and (ii) the social vulnerabilities they will be facing (Breil et al., 2021).

- *Principle 2.* A wide inclusion of social groups in planning, implementation and monitoring processes is to be sought (Pieraccini, 2019; Breil et al., 2021). This is especially important for more vulnerable and marginalised groups.

- *Principle 3.* Efforts need to be made not just to achieve a wide inclusion, but also to ensure that all are recognised, are allowed to understand the issue being discussed, to express their view and ultimately to influence the outcome (Pieraccini, 2019; Breil et al., 2021). Once again, this is particularly relevant for more vulnerable and marginalised groups, who are less likely to effectively participate due to information and cultural barriers or unequal power relations.

- *Principle 4.* Just resilience policies should distribute both burdens and benefits of policy measures equally across social groups: all communities are to be protected from the negative effects of climate change and associated policies, and positive effects must not have a social bias.

At a minimum, they do not have to aggravate existing (social) gaps and vulnerabilities (Breil et al., 2021). Therefore, it is also important that the interaction of new policies with pre-existing ones is evaluated ex-ante and monitored ex-post.

- *Principle 5.* Just resilience policies should not introduce new vulnerabilities — neither in a given area, nor across regions or generations. Moreover, they should have a primary objective of mitigating risk, rather than redistributing risk and vulnerability from one cohort to another (Lager et al., 2021; Breil et al., 2021).

- *Principle 6.* Even if all the aforementioned principles are followed, an element of uncertainty remains, and there may be instances where regressive effects are witnessed. However, policy-makers should be mindful that redistribution of wealth is only one of the tools in the arsenal of just resilience. Other tools include retraining, rehabilitation, and improved physical and psychological well-being.

Following these principles, the just resilience of social systems for Irish policy decision-making may be defined as the combination of procedures that allows for a wide inclusion, full recognition and effective participation of all cohorts, especially more vulnerable ones, in decision-making processes. In doing so, the consideration of policies for just resilience should address climate and social threats without shifting vulnerabilities to other constituencies, exacerbating other pre-existing vulnerabilities and creating new ones.

3 Framework of application

Having defined the concepts of just resilience and summarised the principles of application, this section presents a unified framework of analysis for policy decision-making. We consider the application for our case study of Ireland, but the approach may be readily adapted for application to alternative contexts. As discussed previously, climate impacts of greatest concern in an Irish context include those relating to extreme weather events, flooding, and more frequent instances of drought (Northern and Western Regional Assembly, 2020). In this section, we consider how Irish policy may account for these impacts in their decision-making processes.

Many frameworks exist to define just resilience in various contexts, with some offering insight into how policy can address this. Dastjerdi et al. (2021), for instance, defines a resilient location as that which features a combination of physical and non-physical characteristics that can contribute to

improved response and adaptation to a broad range of natural and manmade hazards. They define such societal resilience according to eight dimensions: organizational, institutional, environmental, economic, social, infrastructural, physical, and spatial. Similarly, Tyler and Moench (2012) integrates infrastructure, ecological, institutional, and social resilience factors to provide a framework of urban climate resilience that facilitates planning for climate adaptation in cities. They pay considerable attention to the characteristics of an urban space that is resilient to climate change.

Many frameworks - such as those outlined above - are qualitative, but quantitative frameworks also exist. In a related literature, focussed on resilience to earthquakes rather than climate change specifically, Bruneau et al. (2003) presents a conceptual framework with four dimensions which gauge communities' seismic resilience. The four dimensions comprise organizational, technical, economic, and social resilience were quantitatively measured. This paper provides a shift from a qualitative conceptualization to a quantitative approach to integrating measures of resilience properties. The framework was based on three quantifiable objectives: reducing the probability of failure; reducing failures' consequences; and reducing the recovery time Tamvakis and Xenidis (2013). While these approaches to analysis are effective in identifying what a resilient community may look like, the policy response to achieve this, and the steps required in the decision-making process, are not the focus of this analysis.

There exists a related literature identifying principles with which climate resilience policy should adopt in order to ensure equitable impacts. Moser (2008), Moser and Satterthwaite (2010) and Banks and Moser (2011) advocate for an asset-based approach called 'pro-poor adaptation,' where investment in the assets of vulnerable communities is prioritised. Hastings (2007) promotes "territorial justice" for service provision, with the objective of matching provision with the level of need.

Figure 1 presents a decision-making framework that draws on the preceding definitions of just resilience in Section 2 and the principles outlined in Section 2.3. This draws heavily upon many strands of academic literature, most notably issues of societal resilience; disaster management Manyena (2006); Tran et al. (2009); FEM (2021); risk assessment Norris et al. (2008); Paton and Johnston (2001); Union (2008); alongside methods to cope, adapt, and transform in response to climate change policies. The framework is divided in three main stages, each of which will now be discussed.

3.1 Stage 1: Pre-policy implementation

Stage one of the framework is the pre-policy stage. At this point in the process, the policymaker must identify all relevant stakeholders and the nature of the impact that is being considered (Davoudi et al., 2012; Davoudi, 2018). If the policy is considering the resilience of the population to climate impacts such as flooding, for instance, this may encompass effective consideration of how flooding may affect various stakeholder groups. In particular, decision-makers should be cognisant of socioeconomic drivers of inequality and distributive injustice, as previously outlined. In addition, the policy must ensure procedural justice. This begins by identifying the decision-makers that should be central to the policy response. The principles of procedural justice, previously outlined, may inform such consideration. In particular, this should include representation among the affected communities, considering local heterogeneity in ethnicity, caste, class, gender, ability or other socioeconomic factors (Fairhead et al., 2014; Seddon et al., 2021).

In order to correctly identify the appropriate response, policy must consider institutional factors that may impede the incorporation of relevant stakeholders in the decision process, or which may impede implementation of the most effective policy. Hayward and Swanstrom (2011) finds that there are three potential mechanisms of injustice relating to the political economy of poverty, which may be relevant in this context (Hughes, 2013). The first mechanism comprises the existence of thick injustice, which is concerned with inequality beyond economics, exploring how social, cultural, and historical factors contribute to observed injustice. The second mechanism is concerned with the existence of technocratic governance that inadvertently leads to inequitable outcomes. Technocratic governance implies that decisions made by technical experts or bureaucratic structures may inadvertently contribute to inequality, emphasizing the need for a critical examination of governance strategies to ensure they are just and equitable. The third mechanism is concerned with the extent to which institutions have the appropriate capacity to effectively enact just policy. Policy must evaluate the ability of institutions such as government bodies, legal systems, or social organizations to enact policies and practices that promote justice. Together, these mechanisms underscore the need for comprehensive and nuanced approaches that address not only economic disparities but also social, governance, and institutional factors contributing to injustice (Foran, 2016; Mehta et al., 2021; Jennifer L. Rice and Heynen, 2015).

Having explored these issues, the policymaker should have a clear understanding of the likely impacts on affected stakeholders, the decision-makers that should be incorporated into the decision process and the potential impediments to effective policy implementation. These are important

prerequisites for effective policy design, which then follows in Stage 2.

3.2 Stage 2: Policy Implementation

Stage two is the policy implementation stage. The policies to be implemented may be grouped according to three categories, coping, adaptation and transformation. Policies categorised as 'coping' strategies involve those that aid stakeholders to overcome adverse effects in the short term (Keck and Sakdapolrak, 2013; Adger, 2000; Smit and Wandel, 2006). The policies which are commonly employed as part of a coping initiative are outlined in Figure 1 and cover aspects of the immediate response to a perturbation. Resource mobilisation - financial and material mechanisms to support emergency response efforts in the event of a physical event such as a flooding event, is a common first step. If this is of a considerable size, this may involve coordinating with local and international aid agencies for gathering supplies (Adger, 2000). In cases of traumatic climate events, such as a large flood event, psychological first aid and mental health services for affected individuals and communities (Norris et al., 2008) may be required. Provisions of shelter and safe haven development may also be required in the aftermath of large-scale events (CDC, 2017; FEM, 2021; Tran et al., 2009). In a broader context, coping strategies could involve incentives to widen the accessibility or provision of insurance coverage (Mills, 2009). Additionally, ensuring access to essential communication can keep people informed about the approaching challenges (Olausson and Berglez, 2018; O'Neill and Boykoff, 2012).

To provide a more concrete understanding of what this stage entails, one may consider coping strategies introduced under different contexts. In Ireland, the essence of coping strategies was bought out by the COVID-19 pandemic, as soon as the pandemic was announced, the coping strategies came to light. Efforts were made by the government to actively engage communities, and communicate the message (Gilmore et al., 2020). Resources were mobilised for healthcare and also supplies were gathered to make sure people could sustain themselves during the lockdown. There were COVID-19 helplines created to provide the public with psycho-social first aid (Crowe and Sarma, 2022). private patients are often treated in public hospitals, subsidised by the State through tax relief on private health insurance premiums (Thomson et al., 2020), this collaboration between the government and the private sector is essential to build resilience.

The second category of policy involves adaptation. Such policies occur on an intermediate time horizon, whereby focus shifts from an immediate response towards an ability to adjust to face the additional challenges arising from the given perturbation (Keck and Sakdapolrak, 2013; Folke, 2006).

However, adjustment falls short of a complete shift to new activity but rather encompasses remedial action to adjust to a new set of conditions. Building infrastructural resilience may take a central part of this step. This includes retrofitting critical infrastructure such as bridges, hospitals, and utilities to withstand potential shocks and stresses. Future infrastructural projects may have to build-in redundancy and multi-use features to ensure future climate-proofing (Union, 2008), with regulation and policy necessary to account for this.

In addition, adaptation incorporates learning and adjusting in response to change, incorporating lessons from past experiences for enhanced resilience. To this end, there are a number of key elements that policy may wish to consider. First, the policy may wish to carry out a risk assessment to identify current and emerging threats (Smit and Wandel, 2006; Hughes, 2013), promoting climate literacy, and awareness about changes (Amorim-Maia et al., 2022; Anguelovski and Carmin, 2011). Adaptation also includes prioritising localised decision-making, by decentralising decisions and empowering local communities (Union, 2008). Hughes (2013) proposes three criteria for just urban adaptation: representation of vulnerable groups in planning, prioritizing their needs, and ensuring outcomes benefit these groups.

To bring out the nature of adaptation measures using a policy case study, one may consider extreme weather events such as storm events. Storms Ciara and Dennis hit Ireland and the United Kingdom in February 2020. The storms brought heavy rain and strong winds, causing disruptions across various regions. The storm led to flooding in several areas, particularly along rivers and coastal regions (Jardine et al., 2023). There were reports of fallen trees, power outages, and transportation disruptions. The Irish government, through agencies such as the Office of Public Works (OPW) and Met Eireann (the Irish Meteorological Service), conducts risk assessments to identify areas prone to flooding. These assessments involve evaluating factors such as topography, hydrology, and historical flood data to inform preparedness and response strategies (Hendry, 2021). During and after storm events, authorities use various channels to disseminate information about climate risks, preparedness, and the importance of climate resilience to enhance public understanding. Infrastructure resilience is a key focus in Ireland's response to storms. This includes designing and maintaining critical infrastructure, such as flood defenses, to withstand extreme weather events (Jaroszweski et al.). The decentralized approach by giving the decision-making power to the locals ensures that responses are tailored to the specific needs of communities (Jardine et al., 2023). Lastly, Ireland recognizes the importance of ecosystems in natural flood management. Ecosystem-based approaches include preserving and restoring natural habitats such as wetlands and forests, which can act as natural

buffers against flooding and are covered under the nature-based solutions against flooding (Jardine et al., 2023; Parry et al., 2020).

The third step is transformation. Transformative capacity involves crafting institutions that promote individual welfare and sustainable societal robustness against future crises (Keck and Sakdapolrak, 2013). Wardekker et al. (2010) emphasizes that a resilient system should encompass the dynamics to accommodate trends and co-evolve. Similarly, Pelling (2010) and Elmqvist et al. (2019) underscore the need for profound changes and transformations in the context of climate change. Transformation can be a holistic change in fundamental structures, values, and functions, often resulting in a qualitatively different state. Some immediate actionable to achieve transformation include green infrastructure, such as green rooves, permeable pavements, and urban forests (Elmqvist et al., 2019). Climate-responsive land-use planning is an additional facet. This includes careful consideration of various factors, including environmental, social, and economic considerations, to guide the development and use of land (Pelling, 2010). For example, this may include the avoidance of construction in flood-prone areas or preserving green spaces to act as natural buffers against climate-related hazards.

Transformation encompasses infrastructure changes but it also should incorporate changes to institutions. Institutions refer to both, formal and informal institutions (Lauth, 2015). Formal institutions are established, recognized, and structured organizations or systems that have specific rules, regulations, and roles eg. government, educational, legal and financial. Whereas, informal institutions are unwritten, implicit, and often socially embedded rules, norms, and practices that guide human behaviour within a society or community (Lo, 2013). Unlike formal institutions that are typically codified in laws or official regulations, informal institutions operate based on shared beliefs, traditions, and expectations. Transformational steps are those which change the structure, policy, practices and culture of institutions; both formal and informal, to build resilience (Agrawal et al., 2008; O'Riordan and Jordan, 2019).

Institutional change for resilience includes policy change and making interconnections between different formal and informal institutions (Wardekker et al., 2010). Transition to a circular economy, which comprises steps to minimize waste, energy consumption, and resource depletion. This can reduce vulnerability to economic shocks and resource scarcity (Folke et al., 2004). Lastly, it is crucial to encourage collaboration between research, industry, and government (Haas et al., 2015; MacArthur, 2015).

The transformation category under stage 2 is bought to life using the case study of Irish Climate

Action Plan (CAP) (Torney, 2021; Department of the Environment and Communications, 2024). The Climate Action Plan is a comprehensive strategy developed by the Irish government to address climate change challenges. It outlines key initiatives that involve green infrastructure, land use planning, circular economy principles, changes in institutions and collaboration between various stakeholders. The plan emphasizes the development and enhancement of green infrastructure (Matthews et al., 2015; Lennon, 2015), this includes afforestation, the creation of urban green spaces, and the protection and restoration of natural habitats. Integrated land use planning strategies are incorporated to ensure sustainable urban development, reduce vulnerability to extreme weather events, and enhance overall environmental quality (Haughey, 2021). The Circular Economy Innovation Fund supports initiatives that contribute to a more circular economy, fostering collaboration between government and industry to drive innovation (Mazur-Wierzbicka, 2021). Research initiatives are supported through various funds, including the Climate Innovation Fund, to drive innovation in areas such as renewable energy, sustainable agriculture, and climate resilience. Moreover, government-industry partnerships are crucial for implementing sustainable practices, developing green technologies, and ensuring the success of circular economy initiatives (Davoudi, 2018; Davoudi et al., 2009).

While implementing these three steps of coping, adaptation and transformation, there is a common step that must be adhered to, which is making sure procedural justice is retained (Pieraccini, 2019; Breil et al., 2021). To ensure procedural justice, there should be a comprehensive inclusion of vulnerable cohorts in decision-making (Lager et al., 2021; Breil et al., 2021), being aware that, participation and inclusion do not automatically translate to representation (Morello-Frosch, 2002). This can be achieved by making sure that the priorities of vulnerable groups are aligned (Agyeman and Evans, 2003; Coggins et al., 2021), and making sure both internal and external exclusions are minimised (Elmqvist et al., 2019).

These steps are aligned with adaptation measures, especially in the context of Ireland. The Northern and Western Regional Assembly's Regional Economic and Spatial Strategy (RSES) identified a number of climate risks that are most important in an Irish context, including a rise in sea levels, changes in rainfall events, increased frequency of storm events, changes to air and soil temperature and periods of increased drought (Northern and Western Regional Assembly, 2020). Further, Solomon (2007) claims that there is an increased chance of intense precipitation and flooding due to "greater water-holding capacity of a warmer atmosphere", and it is expected that "such events will continue to become more frequent". Gharbia et al. (2016, 2018); Alexander et al. (2016) suggest in an Irish context that precipitation intensity is estimated to increase almost everywhere, but particularly at mid and

high latitudes where also the mean precipitation is anticipated to increase, with a resulting impact on the risk of flash flooding and urban flooding, this brings with it the additional consequences of rise in sea levels, increased frequency of storm events. The coping, adaptation, and transformation measures discussed are framed with the Irish context in consideration, thus the steps mentioned in the framework flesh out policy steps for such scenarios, this is the scope of the proposed framework.

The policymaker must be careful, that sometimes, despite having all these actions in place, the disturbances of the constructed policy might get displaced onto, other groups. Some of these groups might be, inter-generational and future generations (Daly, 2017), marginalised communities (Adger, 2000), future governments (Lebel et al., 2006) and transboundary regions or across borders (Biermann and Pattberg, 2012).

3.3 Stage 3: Post policy

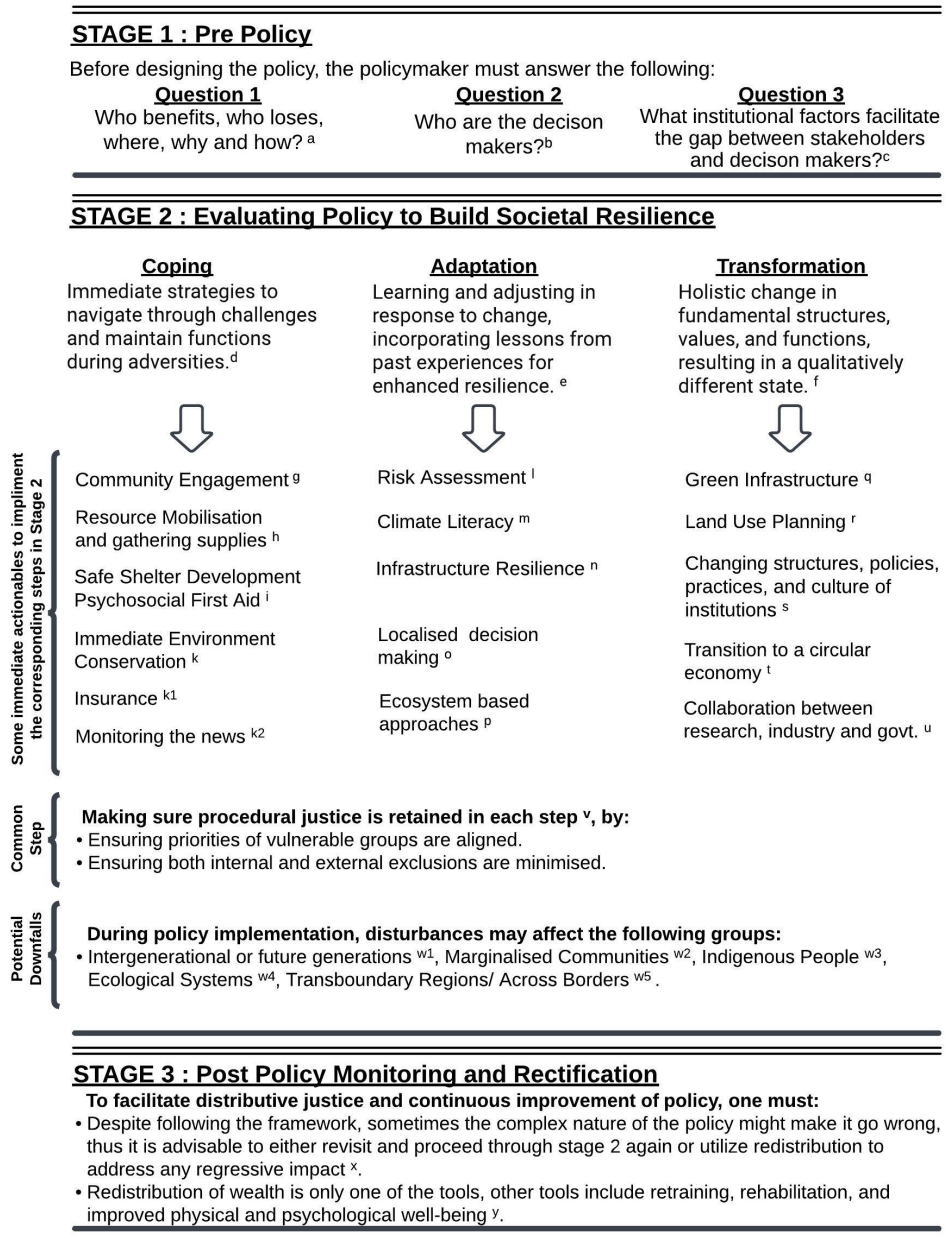
The third and last stage is, post-policy monitoring and rectification. Reviewing and reassessing the policy retrospectively is essential. Even if all the aforementioned principles are followed, an element of uncertainty remains, and there may be instances where regressive effects are witnessed. Sometimes the complex nature of the policy may result in the actual effect deviating from that expected, thus it is advisable to review the policy impacts to ensure that outcomes align with those predicted ex ante. Policymakers may wish to consider the potential impact of the policy on vulnerable populations, such as low-income households or otherwise vulnerable socioeconomic cohorts (Carley and Konisky, 2020). The policy also might have differential impacts on different regions or communities. Some policies may disproportionately affect areas with a higher concentration of lower-income households (Biermann and Pattberg, 2012). Reflecting on 1 it is crucial to assess whether the policy development process included input from diverse stakeholders, including those from lower-income backgrounds. Policies developed without adequate representation may inadvertently be regressive (Davoudi, 2018; Seddon et al., 2021). Additionally, considering the long-term effects of the policy on socio-economic dynamics is important. Some policies may have short-term regressive impacts but positive long-term effects, so it's essential to analyze the policy in the long term (Kriegler et al., 2012).

Should a descrepency be observed, it may be required to repeat a given step, correcting for the descrepency, or implement additional policies (Ikeme, 2003; Coggins et al., 2021). Such corrective action may incorporate the use of tax-benefit policy to overcome any observed regressive impacts, or may also include interventions such as retraining, rehabilitation, improved physical and psychological well-being, and targeted subsidies or rebates for low-income households (Barton, 2009; Mosca et al.,

2021).

In conclusion, policies serve as dynamic and context-specific tools, woven into the fabric of social, political, and legal landscapes. The complexity of societal challenges necessitates adaptable policy frameworks that can evolve with changing circumstances. Continuous monitoring of policy impacts is not just a procedural formality but a fundamental requirement for ensuring efficacy and the avoidance of unintended consequences.

Figure 1: Decision process framework for just resilience



Note: Sources [a] Davoudi (2018) Davoudi et al. (2012) Sultana (2022) Markkanen and Anger-Kraavi (2019) Reckien et al. (2018b) O'Brien and Leichenko (2003) [b] Davoudi (2018) Davoudi et al. (2012)Fairhead et al. (2014)Seddon et al. (2021) [c] Ebi and Semenza (2008) Hughes (2013) Foran (2016) Mehta et al. (2021) Jennifer L. Rice and Heynen (2015) Elmqvist et al. (2019) [d] Keck and Sakdapolrak (2013) Adger (2000) Smit and Wandel (2006) Walker et al. (2004) Folke et al. (2004) [e] Keck and Sakdapolrak (2013) Folke (2006) Hughes (2013) Anguelovski and Carmin (2011) Folke (2006) [f] Keck and Sakdapolrak (2013) Wardekker et al. (2010) Elmqvist et al. (2019) Pelling (2010) Lebel et al. (2006) [g] Smit and Wandel (2006) [h] Adger (2000) [i] CDC (2017) FEM (2021) Tran et al. (2009) Norris et al. (2008) [k]Manyena (2006) Paton and Johnston (2001) [k1] Mills (2009) [k2] (Olausson and Berglez, 2018; O'Neill and Boykoff, 2012) [l]Smit and Wandel (2006)Hughes (2013) [m]Amorim-Maia et al. (2022)Anguelovski and Carmin (2011)[n]Union (2008) [o] Hughes (2013) [p] Folke (2006) Folke et al. (2004) [q] Elmqvist et al. (2019) [r] Pelling (2010) [s] Wardekker et al. (2010) [t] Haas et al. (2015) MacArthur (2015) Folke (2006) [u] Elmqvist et al. (2019) Haas et al. (2015) [v] Agyeman and Evans (2003) Coggins et al. (2021) Paavola and Adger (2002a) Elmqvist et al. (2019) [w1] Daly (2017) [w2] Adger (2000) [w3] Mason and Rigg (2019) [w4] Peterson et al. (1998) [w5] Biermann and Pattberg (2012) [x] Paavola and Adger (2002a) Coggins et al. (2021) Ikeme (2003) Paavola and Adger (2002b) [y]Barton (2009); Mosca et al. (2021)

4 Conclusion

This paper has provided a comprehensive definition and framework of application of just resilience for policy decision-making. This has taken a general perspective that is appropriate for decision-makers in high income countries, focussing on Ireland as a representative case study. Just resilience incorporates two aspects, distributive justice and procedural justice. Both of these facets are incorporated into a comprehensive definition and framework of application that stresses the importance of a wide inclusion and effective representation of all vulnerable groups, so as to put in place adaptation measures that target the causes of vulnerability and avoid shifting or creating new inequalities.

This paper provided an overview of the concepts of both procedural and distributive justice, and the role they play in building resilience. A number of principles of effective just resilience policy have been considered in the literature, and these have also been reviewed. Taking these concepts, we have proposed a decision-making tool for policy to follow such that just resilience can be effectively incorporated into the decision-making process. This is a 3-stage framework. We have identified how this framework may be applied in the context of climate impacts similar to those observed in Ireland, with the framework readily adapted to other contexts.

While this paper has established important elements to be considered when implementing just resilience in a country such as Ireland, further research is needed to improve our understanding on a number of aspects. In particular, we have highlighted the concepts and definitions of what is required for effective inclusion of just transition concepts in policy decision-making, however much less evidence exists as to how this may effectively be achieved. The law and philosophy literature should continue to seek solutions for the effective inclusion and representation of all stakeholders in the decision-making process, particularly difficult-to-define cohorts such as future generations.

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