D2.2 Just Transition Framework

Regions 4Climate

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List of Acronyms

AR/VR	Augmented Reality/Virtual Reality
EU	European Union
GDP	Gross Domestic Product
IPPC	Intergovernmental Panel on Climate Change
NGO	Non-governmental organisation
NBS	Nature-based Solutions
PESTE	Political, Economic, Social, Technological, and Environmental
PPS	Purchasing Power Standard
R4C	Regions4Climate
SECAP	Sustainable Energy and Climate Action Plan
SME	Small and medium-sized enterprise
UHI	Urban Heat Island

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Keywords list

- Climate justice
- Climate resilience
- Roadmapping
- Systemic change
- Transformation

Disclaimer

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Executive summary

Climate change will severely affect regions, communities and livelihoods across the EU and globally. Adapting to the changing climate is inevitable. Yet, if the process of climate change adaptation is not carefully thought through, it risks aggravating already existing inequalities in society and exacerbating the burdens for those who are most affected by the impacts of climate change. This calls for a just transition for climate adaptation.

Building climate resilience requires more than small, incremental steps. Rather, a larger societal transformation is needed. This calls for actively transforming the ways in which we live and govern our society to make it more capable to adapt to a changing climate. All societal groups should have the possibility to participate actively and shape this transformative process.

In this paper we present a Just Transition Framework for climate resilience. It outlines **ten enablers and barriers for transformation** (including path dependency, participatory decision-making, practical experiments, and mindset change) and is grounded in the following **four dimensions of justice**:

- Recognitional justice - who is recognised as a stakeholder?
- Procedural justice - how are stakeholders included in adaptation processes?
- Distributive justice - what is the distribution of impacts, rights and responsibilities?
- Restorative justice - are pre-existing harms and injustices subject to restoration, reconciliation and compensation?

Further, the Just Transition Framework is based on **five key steps for the roadmap process**:

- *S*cope and context building – considering baseline data and the expected level of systemic change
- Actor identification and involvement - involving stakeholders, including marginalised and vulnerable groups
- Defining a vision and goal together - envisioning the ideal state of climate resilience and formulating goals
- Defining actions together - facilitating the transition process with an emphasis on climate justice
- Official approval of the roadmap - ensuring commitment by key actors

Each of the five steps is supported by a catalogue of specific tools and methods that can be adopted in the processes of building just transition roadmaps.

Overall, this Just Transition Framework aims to serve as a cornerstone for building climate resilience in the 12 regions in the Regions4Climate project.

1. Just Transition to Climate Resilience

In 2023, Europe has witnessed heatwaves, wildfires, floods, landslides, and rockfalls. 2023 was the warmest year globally since 1940, and July 2023 was the hottest month and 1.5 °C warmer than the preindustrial average (Copernicus Climate Change Service, 2023b, 2023d). The heatwaves and wildfires in Southern Europe exemplify these record-breaking temperatures (Copernicus Climate Change Service, 2023c) and in several regions these were followed by severe floods triggered by extreme precipitation (Copernicus Climate Change Service, 2023a). Recent rockfalls in the Alps are associated with the thawing of permafrost (Hendrickx et al., 2022).

This means people have been unevenly exposed to climatic extreme events. Furthermore, among those exposed to the same weather conditions, people have not had the same capacities to cope with the situation. There are differences in people's capacity to adapt to and prepare for changing climatic conditions and to recover from the impacts of extreme events, i.e., individuals and groups are vulnerable to varying degrees to climate change (unequal burden, see Figure 1).

We can understand the consequences of climate change in the wider context of modernisation (Beck et al., 1994). The very enablers of modernisation themselves, such as science and technology, which have made development possible, generate risks and unintended consequences of unprecedented magnitude affecting human societies and eventually our entire planet. Beck (1994 l p. 2-24) speaks of *reflexive modernisation* describing the risks reflecting back onto society, and the recognition of these consequences and the resulting critique directed towards the current institutions of modernisation. Anthropogenic climate change, and how we react to it, is not a purely technical apolitical challenge, but an object of political debate that requires new forms of governance and collective action.

The unavoidable impacts of climate change (irrespective of all climate change mitigation efforts), the severity and number of extreme events, and the unequal distribution of the burdens of climate change can be summed up by a situation where climate resilience requires more than small, incremental steps. A larger societal transformation is needed to address current extreme climate events and challenges, as well as climate change in the mid- and long-term (European Commission, 2019, 2021a). The notion of transformation includes the fact that climate resilience does not mean the fortification of our current situation against any type of change, but the active transformation of the ways how we live, work, and govern our society to make it more capable to cope with and adapt to a changing climate and extreme climate events (European Commission, 2020; Heikkinen et al., 2019; Moser et al., 2019; Shi & Moser, 2021).

Transition to climate resilience must be inclusive for everybody. All societal groups should have the possibility to participate actively and shape this transformative process. Also, the benefits, costs, rights, and responsibilities in this process should be distributed in a fair way, and nobody should be more vulnerable or marginalised because of the transition to climate resilience. This is also referred to by the notion of "leaving no one behind" (Lager et al., 2023).

Figure 1. The two core aspects of just resilience: dealing with unequal burdens (climate change impacts and risk) and leaving no one behind (inclusion in and effects of adaptation action) (source: Lager et al., 2023 under CC BY 4.0)

So far, there is little evidence that these processes would be under way. On the contrary, current climate change adaptation is often described as being technocratic, incremental, and in the worst cases creating new or reinforcing already existing inequity, vulnerability, and marginalisation (Amorim-Maia et al., 2022; Anguelovski et al., 2018; Kehler & Birchall, 2023; Meerow & Mitchell, 2017; Moser et al., 2019; Shi et al., 2016). All these factors – the urgency of building climate resilience, pre-existing unequally distributed vulnerability, the size of the challenge requiring transformative action, and the inadequacy of current efforts – spell out the need for just transition to climate resilience. In this deliverable, we offer a conceptual background and concrete steps to foster this process at the regional level.

With the Regions4Climate Just Transition Framework, we aim to provide a sound basis for defining actionable, region-specific roadmaps for just transition to climate resilience in 12 European partner regions of the Regions4Climate project. The framework enables the recognition of past and current disadvantages in society, potential unequal exposure to climate impacts, and burdens and benefits of adaptation measures, as well as supports inclusive adaptation throughout the roadmap planning and implementation cycle. Justice here refers to removing systemic barriers and inequalities, supporting those who are more in need and thereby enabling long-term equitable outcomes (Coggins et al., 2021; Schlosberg, 2007). The framework is adaptable to the specific needs of the regions. It supports them to build a vision of just climate resilience and to define actions paving the way for this vision.

In the following chapters, we first lay out the conceptual underpinnings of adaptation justice (Chapter 2), and then elaborate on the differentiation and touch points of transition and transformation as well as on potential leverage points, enablers and barriers for transformation (Chapter 3). Based on this conceptual background, Chapter 4 presents an overview of potential challenges with respect to adaptation justice and identifies possible enablers and barriers for a transition towards climate resilience in each of the 12 European partner regions of the Regions4Climate project. Chapter 5 describes five steps of a roadmap process for the just transition to climate resilience including a selection of tools and methods for each of the steps. In conclusions (Chapter 6), we elaborate on the potential and limitations of the Just Transition Framework and related roadmap process (see Figure 2).

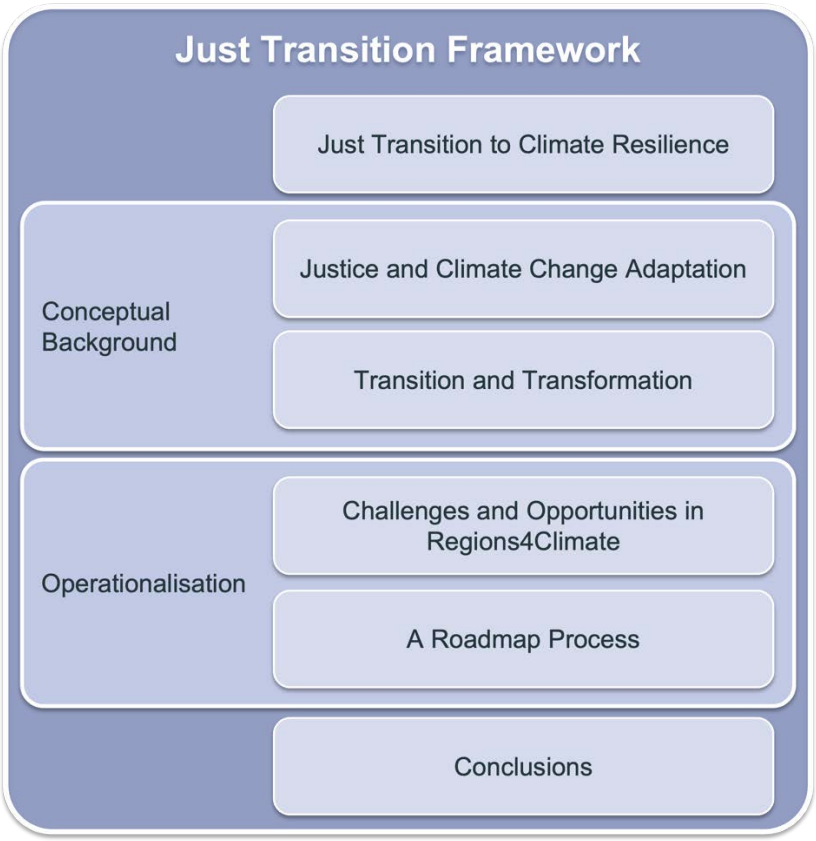

Figure 2. Overview of the structure of the Just Transition Framework including an introduction to just transition to climate resilience, the conceptual background, its operationalisation and conclusions

2. Justice and Climate Change Adaptation

As research and practice on resilience and adaptation to climate change advances, it is becoming apparent that questions of justice and equity need to be brought forward more strongly in all stages of the policy cycle, starting from planning towards monitoring and evaluation (Chu & Cannon, 2021; Shi et al., 2016). It is evident that there is a need for improvement in participation of the stakeholders in the decision-making, implementation, and evaluation processes (Chu & Cannon, 2021; Klein et al., 2018). The impacts of climate change are distributed unequally not only due to the hazards' magnitude or location, or individual sensitivity characteristics (such as e.g., age or health status), but also due to the underlying societal structures that create or exacerbate some of the sensitivity characteristics as well as negatively affect capacities to prepare, respond, and recover (Hughes & Hoffmann, 2020; Thompson & Otto, 2015). Similarly, the effects of adaptation and resilience efforts are distributed unequally as are the cost burdens. It is thus pertinent to carefully evaluate adaptation and resilience efforts from the perspectives of a) participation of people affected by climate change or adaptation to it with special attention to marginalised and vulnerable groups, b) just and equitable distribution of positive and negative impacts of adaptation, c) potentials for restoring past injustices and compensating for the unequal distribution of climate impacts and maladaptation, and d) prevention of emerging injustices.

Justice in climate adaptation is approached through four dimensions (Juhola et al., 2022), that also support the enforcement of the two Commission principles: "unequal burdens" referring to distributive justice in acknowledging unequal and inequitable distribution of climate impacts and adaptation costs, rights, responsibilities and outcomes, and "leaving no one behind" referring to recognitional, procedural and restorative justice as we advance in just transition to climate resilience. It is valuable to approach adaptation justice also through other lenses, such as spatial, temporal, and intergenerational justice (Lager et al. 2023). As many of the adaptation efforts shape our environment, it is pertinent to also consider the socio-spatial dialectics (Soja, 2010), i.e. understanding how social and spatial aspects shape each other and what are the consequences of adaptation efforts for both in terms of distribution of adaptation benefits and burdens or creating new spatial injustices (for example, green gentrification, Anguelovski et al., 2018). Temporal and intergenerational justice add another layer of understanding on the existing capacities and resources (recognitional justice) and provide a basis for planning adaptation and resilience efforts that can have restorative effect or at least avoid perpetuating the existing inequalities, such as e.g. time resources or inequalities passed through generations (Goodin, 2010; Page, 1999).

1) Recognitional

Recognitional justice in adaptation and climate resilience refers to the acknowledgement of the diversity of groups and needs to adapt, as well as existing societal structures or norms that create unequal conditions and differing vulnerabilities to climate risks, to the risks of transition, as well as capacities to adapt. These may include intergenerational, cultural, socioeconomic or political structures creating disadvantaged positions or structural vulnerabilities (Chu & Cannon, 2021). Just climate adaptation and efforts to enhance climate resilience need to acknowledge these structures and the resulting plurality of needs while securing basic human rights.

2) Distributive

Distributive justice concerns the distribution of rights and responsibilities to adapt, as well as the climate and adaptation impacts across society (Chu & Cannon, 2021), including both positive and negative impacts. The distribution of impacts and vulnerabilities can be examined with the help of vulnerability and risk assessments to inform adaptation planning as well as subsequent monitoring to make necessary changes upon evaluation. The distribution of adaptation rights, responsibilities, and impacts needs to be assessed as part of adaptation strategy and monitored continuously, examining positive, negative or unintended outcomes. Additionally, the costs of adaptation should be identified, and their equitable distribution assessed and monitored.

3) Procedural

Procedural justice refers to equitable participation of stakeholders or actors in adaptation process, from planning and implementation to evaluation and update. This presupposes that the decision-making is transparent and accountable and includes diverse stakeholder groups and their needs (Chu & Cannon, 2021). Participation should extend beyond public sector and include experts, citizens, marginalised and vulnerable groups, as well as groups possibly affected by adaptation actions, and the participation extent ranging from by invitation only to fully open participation, from information dissemination, consultation, to a collaborative and continuous process.

4) Restorative

Restorative justice is an emerging issue stemming from the loss-and-damage debate (Boyd et al., 2017). Harm and injustice need to be acknowledged (S. Robinson & Carlson, 2021) and attributed (Huggel et al., 2013), and possible measures for compensation need to be developed. Harm and injustice can be related both to the unfair distribution of climate impacts as well as to the unfair distribution of negative outcomes of adaptation, i.e., maladaptation (Juhola et al., 2016).

These justice dimensions are closely linked to understanding who is vulnerable to the risks of climate change (Juhola et al., 2022; Schlosberg, 2007). Vulnerability to climate risks refers to a) sensitivity - personal characteristics that may make people more susceptible to adverse outcomes, often including age, education, or health status; and b) adaptive capacity – social factors (e.g., social networks, tenure and crowdedness, accessibility to rescue or health services). Vulnerability to climate risks is thus situational - it manifests when people with susceptibility to adverse outcomes and low adaptive capacity are exposed to climate hazards (Rawshan Ara Begum et al., 2022).

In this framework, we also recognise vulnerability to the risks of transition to climate resilience, i.e., unintended outcomes of adaptation efforts (Rawshan Ara Begum et al., 2022; Simpson et al., 2021). Understanding who these groups of people are requires careful evaluation of adaptation outcomes and their distribution as well as of the distribution of adaptation costs. Additionally, this framework also acknowledges the needs of marginalised groups, i.e. groups of people who are excluded from the mainstream economic, political or social processes (Baah et al., 2019). The premise of the just transition framework is to enhance climate resilience while alleviating or minimising existing inequalities, avoiding their perpetuation or recreation in the future, as well as avoiding creating new ones.

Finally, this framework acknowledges the fluid and dynamic nature of vulnerability and risk (Ford et al., 2018; Jurgilevich et al., 2017; Rawshan Ara Begum et al., 2022). This refers not only to climatic changes, but also to the socio-economic changes and uncertainties associated with both. In that regard, vulnerabilities to both kinds of risks may change and new vulnerabilities and risks may emerge across the groups of people who haven't been previously vulnerable or at risk. This needs to be accounted for in the identification of actors (including also vulnerable and marginalised groups) and guided by the assessment of future risks and vulnerabilities with the help of climatic and socio-economic projections or scenarios, as well as mapping adaptation outcomes in different time horizons. The premise of the Just Transition Framework is that no one is left behind, burdens and impacts are distributed in a fair and equitable manner when they cannot be alleviated, risks and vulnerabilities are not perpetuated or exacerbated, and no new inequalities, vulnerabilities or risks are created in the transition process across short-, medium- and long-term horizons.

3. Transition and Transformation

The notion of **just transition** originally emerged from the labour unions in the United States in the 1970s in response to the human and environmental impacts of polluting industries. Workers' occupational health was impacted by toxic wastes and increased environmental regulation pushed for a change in industrial production (Lager et al., 2021). In the context of climate change and the mitigation of greenhouse gas emissions, just transition has expanded on this by calling for a fair, just and socially sustainable transition away from fossil-based industries to a more environmentally friendly, green economy targeting net-zero emissions (Dzebo et al., 2023). In this process, those sectors, businesses, workers and communities most affected by this transition should be provided with relevant alternative pathways, job opportunities and supporting livelihoods, leaving no one behind.

In recent years, just transition has further expanded from climate mitigation to climate adaptation. Socially just transition for climate adaptation must benefit all, and as a start have a particular focus on those who are most vulnerable and who suffer the most severe impacts of climate change. Or, those groups who suffer from, have limited access to, or do not benefit from the adaptation measures that are being provided by, e.g., local, regional and national governments.

Systems thinking and systemic change

A **system** is a set of parts working together as a whole or an interconnected network of elements. A **social system** refers to the 'human' dimension including, e.g., human perception, preferences, habits, or the economic and financial (sub-)systems, the legal system or the governance system. A **social-ecological system** also includes the dynamics of ecosystems including abiotic factors (e.g. water, air, temperature) and biotic factors (living organisms, flora, fauna), and how the social and ecological systems work in tandem, e.g. in livestock farming, forestry or human-induced environmental change (Folke et al., 2021). **Social-ecological-technological systems** further expand the systemic human-nature interactions with major technological features such as e.g. energy systems, water systems and transport systems, how this creates systemic interfaces and interdependencies – also in the light of climate change (McPhearson et al., 2022).

Systems that involve humans and natural processes are not merely complicated, they are complex (Uhl-Bien et al., 2007). In contrast to complicated systems, such as computer software or airplanes, complex systems cannot be fully understood by analysing the multiple individual constituents of the system. Rather, the interactions among constituents need to be acknowledged and analysed to grasp and work with complex systems. Further, such complex and adaptive systems are characterised by the ability to dynamically interact, self-organise, experiment, learn, memorise and evolve over time (Holling, 2001).

When addressing complex problems, such as regional adaptation to climate change, it can be relevant first to see the societal context, e.g. the city or region, as a **complex adaptive system** (Uhl-Bien et al., 2007). Second, it is relevant to draw on multiple fields of knowledge – not only interdisciplinary scientific expertise (e.g. biology, sociology and economics), but also involving the public sector, the private sector, civil society and academia in a

transdisciplinary **quadruple helix** approach – or seeing the city or region as a **quintuple helix** innovation system where the public-private-academic interactions are nested in the social, political and media-based context of 'society' which again is nested in a wider local/ regional/ national/ global 'environment' (Carayannis et al., 2022). Third, it is relevant to recognise different levels and scales of systems (Cash et al., 2006) and to explore visions for desired futures in the process of fostering systemic change.

Systems can provide deep **regimes** that are resilient to a high degree of internal stresses and can tolerate strong external disturbances without collapsing. Such **resilient systems** can be largely static or – more predominantly – dynamic and in a constant state of change yet staying within the same fundamental regime or 'basin of attraction'. As social systems and social constructs, 'democracy' or 'capitalism' can be regarded as deep regimes that are constantly changing, reorganising, and 'adapting' to internal and external stressors without collapsing as a system. There can also be an interest in shifting from an undesired existing regime to a desired future regime, e.g., in the process of changing the global economy from a largely carbon-based economy to a fossil free global economy. To make this change happen, there can be gradual alterations of the existing system that help making undesired systems shallower or lowering the thresholds to enable regime shifts over time.

The difference between transition and transformation

Transition and transformation initially sound similar as synonyms and in practice, the terms may be used interchangeably. However, referring to the international scientific literature (e.g., Fischer & Riechers, 2019; Hölscher et al., 2018; Kuhl, 2021), the two terms are not synonymous, stress different nuances, and are in many ways complementary.

Transition theory emerged originally from historical analyses of radical changes in systems, e.g., the transition from tall ships to steam liners and how this change in technology had wider systemic impacts on shipping, global trade and mobility, and societal practices at large. One of the key conceptual models in transition theory is the **multi-level perspective** that makes a distinction between three different levels of action in society (Geels, 2002). That is, the 'regime level', which refers to the dominating existing practices, legislation, governance models and trust in technology; the 'landscape level', which includes the deep and slowly changing systemic premises including, e.g., religion and national culture; the 'niche level', which is where new innovations may emerge and where a protected space for experimentation can be provided. Transition theory has been widely used as a theoretical framework to analyse and explain events and transitions retrospectively. In addition, transition management has emerged as a means to steer transitions and to provide tools and methods that can strategically foster and ignite desired processes of change (Loorbach & Rotmans, 2010).

Transformation relates to more fundamental changes of the system or the gradual, maybe evolutionary movement away from an undesired current regime towards a more desired future regime. Transformation stems from the literature on global environmental change and highlights the need for a **fundamental mindset change** among actors in the system for radical systemic changes to occur. This includes new social networks, new connections to ecosystems and the incorporation of physical infrastructure and technology in problem solving (Heikkinen et al., 2019). Further, as stated by Shi & Moser (2021, p. 1) transformative adaptation requires "tackling historical legacies and societal engagement" and redresses the "underlying drivers of societal vulnerability to climate change". To work with transformation and transformative change there is a need to investigate "the factors that

maintain the status quo and strategically addressing them to intentionally shift systems in new directions" (Shi & Moser, 2021, p. 2).

Table 1. Key difference between transition and transformation (Based on Fischer & Riechers, 2019; Geels, 2010; Geels & Schot, 2007; Hölscher et al., 2018; Kuhl, 2021; Shi & Moser, 2021)

	Transition	*Transformation*
Characteristics	Stemming from socio-technical systems thinking Often used in discussions on innovation systems Initially used retrospectively as an analytical framework to explain changes in the past Explanation oriented and focusing on the process The time scale is predominantly short to medium term Systems change through incremental and reformistic actions	Stemming from social-ecological systems thinking Often used in discussions on global environmental change Initially used prospectively as a conceptual framework to steer change towards a desired future Purpose oriented and focusing on the intent and goal The time scale is predominantly long-term Adaptive change occurs though fundamental and deep (transformative) actions

The difference between incremental change and transformative change

A system, such as a city or a region, can stay in the status quo or experience change that is either incremental, reformistic or transformative (Heikkinen et al., 2019). From a sustainability theory perspective, the status quo regime tends to be strongly anthropocentric with a high level of trust in technology, the existing financial system and has little focus on social justice (Hopwood et al., 2005). In this context, the target of incremental change (i.e., change occurring in gradual small increments) is to make adjustments to largely maintain business as usual (Heikkinen et al., 2019). In turn, a transformational regime is grounded in an ecocentric worldview with a high emphasis on socio-economic equity which calls for fundamental changes in power relations and worldviews that go way beyond minor adjustments of the status quo (Hopwood et al., 2005). This is exemplified by Malloy (2021) in the framing of just adaptation. According to Malloy, just transformational change occurs when socially vulnerable groups are directly involved and represented in policy and decision-making processes and when these groups are given power and agency over decisions that affect them. A process that excludes local capacity building and only involves government experts is at the opposite end of the spectrum (as a status quo or business as usual situation) because this maintains and reinforces systemic injustice and hinders the emergence of decentralised political capability. Reformistic change can be regarded as the middle ground situated somewhere in between incremental

and transformative change where there is an “intention to change the features that cause the problems without fundamentally changing the structures”, as stated by Heikkinen et al. (2019).

Levers of systemic change

In the context of transformation Shi & Moser (2021) suggest a model concerning levers of change and types of change. Their model is based on Meadows (1999) and Fischer & Riechers (2019) and informed by Abson et al. (2017). Please see Figure 3, which is an adapted version of the models developed by Shi & Moser (2021) and Fischer & Riechers (2019).

According to Shi & Moser, transformational thinking operates at three major levels and types of change: the material level, the relational level, and mindset level. The three levels are interrelated since material outcomes stem from conceptual, relational and procedural conditions, which again reflect the actors’ underlying mindset and intent.

To deeply transform the existing system there is a need to intervene in the system and create change through the leverage points at different levels. The leverage points close to the balance point of the beam scale (see Figure 3) requires a lot of downward force for the system to change, and might not be effective overall, whereas interventions far out on the lever, due to the leverage effect have more impact on the system as a whole.

The shallow leverage points and interventions can be somewhat mechanistic and concerned with practices, materials and resource flows. The mid-level levers of change address social structures, e.g., in terms of procedural and relational representation, whereas the deepest interventions and most effective leverage points are related to mindsets, values and the more fundamental intent of action. However, the interventions at the far end of the leverage are often the most difficult to implement.

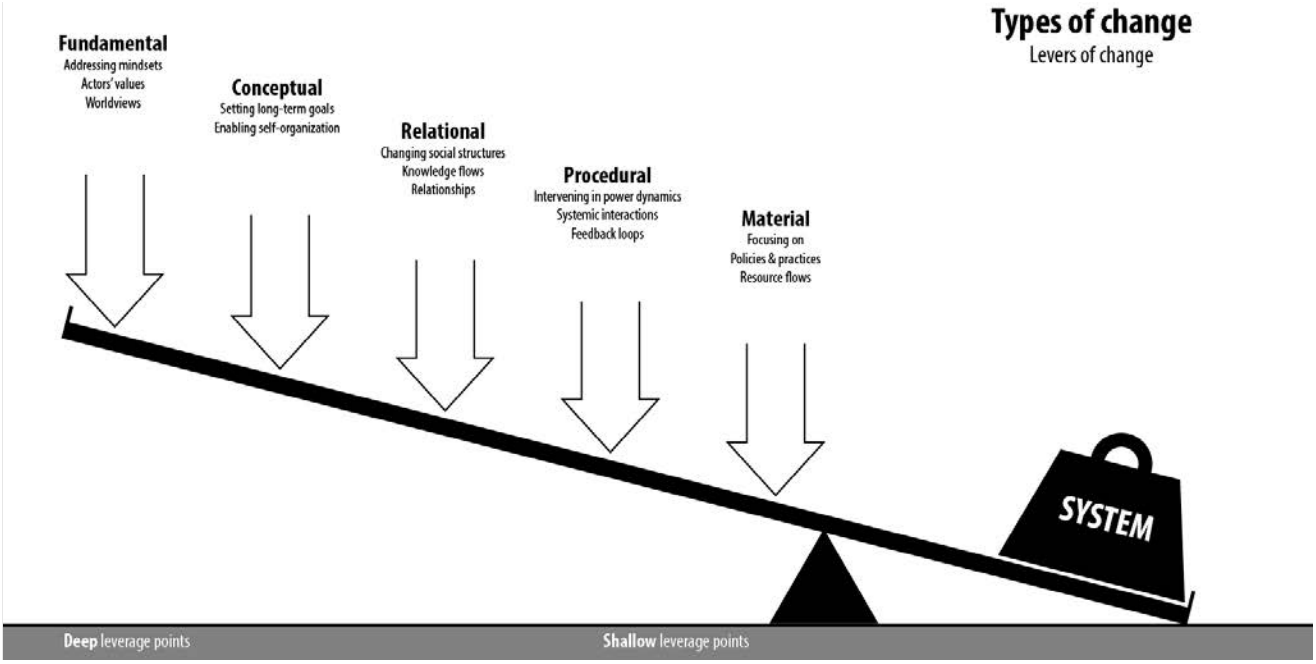

Figure 3. Leverage points for transformative change of systems. Deep leverage points located far out on the lever have much impact on systemic changes but are difficult to implement. Shallow leverage points might be easier to implement short-term but have less force to evoke radical changes to the system compared with deeper leverage points. Illustration by Ole Fryd. Adapted from Fischer & Riechers (2019) and Shi & Moser (2021).

Mapping and synthesising literature on transition, transformation and levers of change

In order to make the theory on transition and transformation more operational, selected international scientific literature has been screened regarding the key concepts of adaptive capacity (Yasmin et al., 2023), complex adaptive systems and social-ecological systems (Folke et al., 2021; Preiser et al., 2018; Uhl-Bien et al., 2007), resilience (Davoudi, 2018; Davoudi et al., 2012; Liao, 2012), social-ecological-technological systems (Grimm et al., 2017; McPhearson et al., 2022), socio-technical systems and the multilevel perspective (Geels, 2002; Geels & Schot, 2007), transformation (Shi & Moser, 2021), transformative capacity (Castán Broto et al., 2019; Shahani et al., 2022; Wolfram, 2016; Wolfram et al., 2019), and transition management (Loorbach & Rotmans, 2010).

Based on the initial review, six complementary key papers on transition and transformation theory have been selected, mapped and compared according to the suggested levels on intervention (Geels & Schot, 2007; Shi & Moser, 2021) to foster systemic change. This mapping exercise has led to the identification and synthesis of ten levers of transformative change, which are compared with the types of change presented in Figure 3. Each lever of change is outlined, explained, and elaborated in Table 2 and in the following section.

Table 2. Mapping and synthesising key levers of transformative change

Concept	Multi-level perspective	Transition pathways	Transition management	Transformative capacity	Transformation	Adaptive capacity	*Synthesis*
Source	Geels, 2002	Geels and Schot, 2007	Loorbach and Rotmans, 2010	Wolfram et al., 2019	Shi and Moser, 2021	Yasmin et al., 2023	
Level, component and lever of transformative change	*Macro level*	Landscape: deep structures			Transformative: mindset, actors' values		*Actors' mindset and values*
		Path dependency	Strategic: societal, long term	Path dependency, system analysis			*Strong path dependency**
				Normative visioning, shared vision	Conceptual: goals	Visions and goals	*Shared vision and goals*
	Meso level	Regime: institutional practice	Tactical: relational sub-system structures		Relational: connections, power dynamics, social structures	Power transfer, distributed knowledge, championing	*Centralized knowledge and power**
				Supportive funding and regulation	Material: resource flows		*Supportive funding and regulation*
				Collective stewardship, public, private, civil society	Procedural: Relationships, connections	Participatory decision-making	*Participatory decision-making*
			Operational: Actors' everyday practices		Material: policies, practices		*Actors' everyday practices*
			Reflexive: ongoing evaluation	Reflexivity	Procedural: feedbacks	Learning, feedback loops	*Learning loops*
	Micro level	Niche: experiments, protected		Practical experiments		Experiments	*Practical experiments*
				Community empowerment, autonomy	Conceptual: self-organization	Bottom-up, polycentric	*Community empowerment*

*) Two factors marked with an asterisk are formulated negatively as a barrier for transformation. The other eight factors are formulated positively as enablers of transformation. Table developed by Ole Fryd based on the sources quoted in the table.

It should be noted that the different strands of literature might collide at an epistemic or ontological level (see e.g., Geels, 2010). The table above is an attempt to provide an overview to help operationalising and translating theories of transition and transformation into practice. Its focus is on the levels of change and the levers of change and the

potential interfaces between different research strands. The conceptual limitations need to be acknowledged, and hence, the table is presented with some reservations from a scientific point of view.

Transformation enablers and barriers

In summary, there are eight transformation enablers and two barriers to have in mind in the process of assessing just transition in relation to climate adaptation initiatives. They are as follows:

Enablers
1. Shared vision and goals
2. Practical experiments
3. Learning loops
4. Supportive funding and regulation
5. Community empowerment
6. Participatory decision-making
7. Monitoring / challenging actors' everyday practices
8. Monitoring / challenging actors' mindset and values

Barriers
9. Strong path dependency
10. Centralised knowledge and power

There is no specific hierarchy in the listing and numbering of the enablers and barriers. Related actions can be implemented concurrently and in no particular chronological order. The enablers and barriers work across different types of change and at different leverages points. See Figure 4.

Figure 4. Transformation enablers (blue) and barriers (red) mapped against the five types of change introduced in Figure 2. Illustration by Ole Fryd.

Below, the eight transformation enablers and the two transformation barriers are explained in more detail.

Wolfram (2016) is used as a key source of information from the scientific literature. Wolfram's conceptual framework can be criticised for being overly normative, theoretical, prescriptive and maybe radical compared with the context of everyday, practical and real-life implementation and actions experienced among regional stakeholders working with climate adaptation. Still, Wolfram provides a series of specific suggestions on components and factors for transformative actions expected to be relevant and helpful for regional actors, facilitators and mediators within the Regions4Climate project who are working on just transition and the development of regional roadmaps in practice.

The ten enablers and barriers have their origin in the notion of transformative capacity. According to Wolfram (2016, p. 126) transformative capacity is defined as "the collective ability of the stakeholders (…) to conceive of, prepare for, initiate and perform path-deviant change."

Transformation enablers

1. Shared vision and goals

There is a collective vision for long-term 'radical' change from the current situation to a desired future situation. The vision is co-developed and widely shared by a diverse group of stakeholders, both professionals and laypersons. The purpose of the vision is to provide orientation for a wide range of strategies and projects.

2. Practical experiments

Diverse practical experiments are being implemented on the ground, e.g., as pilots or demonstration projects. The experiments are place-based or topic-driven, implemented by a small network of dedicated actors, ideally disruptive, and guided by a shared long-term vision for a desired future. These experiments are critically important as catalysts of social learning. Further, the experiments should aim to be holistic, multi-dimensional and simultaneously addressing technological, institutional, cultural and governance aspects. In terms of technological niche experiments (Geels & Schot, 2007), it is acknowledged that early-stage innovations are unstable and maybe low-performance compared to conventional technologies and approaches. Hence, there is an openness to the risk of failure as part of the systemic social learning process.

3. Learning loops

Reflexivity, social learning and positive feedback loops should be linked to all actions for change, including the practical experiments. This includes structured monitoring, assessment and evaluation skills and methods that critically question the level of progress towards the vision, while summarising learnings and providing new insights on how to move forward.

4. Supportive funding and regulation

To enable multi-stakeholder collaboration and to foster the empowerment of local communities, there is a need to provide resources in terms of funding, staff and technical assistance, as well as organisational support. This includes time and resources to build actor coalitions, hiring venues for meetings, as well as the material resources needed for practical experiments. This calls for flexible funding programs that allow for experimental action and the exploration of alternative governance models. This might entail sharing or redistributing resources between actors, e.g., government entities and local communities. Regulations need to be aligned with the vision to support transformative actions and adjusted to remove potential barriers for innovation.

5. Community empowerment

Meeting social needs is central for just transition and local capacity development. Local communities should be empowered to identify unmet social needs and formulate responses. They should be given autonomy and resources (e.g., knowledge, skills and tools) to enhance the level of self-efficacy and self-determination as a means to inform policy and lay out transformative actions.

6. Participatory decision-making

Participatory decision-making and diversified governance structures are necessary to develop the trust, knowledge and political support needed for transformations to occur. This involves the active inclusion and participation of a diverse group of formal and informal actors across sectors, administrative levels and geographical scales. In addition to citizens, civil society organisations, private industry, government agencies and academics, formerly excluded stakeholders should be involved and provided with support to enable their active contribution. Intermediaries can serve as knowledge brokers and help bridging the gaps between different sectors and domains.

7. Monitoring / challenging actors' everyday practices

In transition management, the governance activities can be identified by observing actors' behaviour in the context of societal transitions (Loorbach & Rotmans, 2010). The operational governance activities relate to the everyday and short-term decisions and actions. At the operational level, key regime actors (e.g., government officers, political decision-makers) can recreate and deepen existing system structures or they can actively choose to restructure or change them. Hence, the everyday practices of actors can hinder or support transformative change. Diversified governance structures and social learning processes can help to nurture a transformative change of practice.

8. Monitoring / challenging actors' mindset and values

The choice of policies, practices and resource flows are determined by the processes, relationships, and power dynamics among those making decisions, which in turn reflects the mindsets and values of those involved (Shi & Moser, 2021).

For the desired, positive transformation to take place, stakeholders in the public and private sector and in civil society need to confront the underlying factors that hold the current systems in place. To foster deep cultural change, there is a need to change mindset, shift values and a different set of beliefs about humans and human-nature relations. In this social and cognitive process, transformative actions including capacity development, practical experiments and social learning (i.e. enablers 2 and 3) are imperative to give rise to new values and meanings (Wolfram, 2016).

There is a tension between the urgency of addressing the impacts of climate change and the time needed for transformative actions based on participatory processes, trust building and thorough reckoning with historical legacies. This tension needs to be acknowledged.

Transformation barriers

9. Strong path dependency

Resistance to transformative change partly results from existing physical system components and their service life (e.g., infrastructures, technologies, buildings, ecosystems). In addition, socio-economic and cultural components influence the level of path dependency, including historical legacies, trust in existing technologies, notions of ethics and justice, legislation and finance, as well as the wider institutional reproduction of knowledge, policies and practices. Transformative change requires awareness and recognition among stakeholders of the system dynamics and path dependencies that create barriers for change. A collective analysis of capacities and routines can reveal linkages between the current ways of thinking (cultures), the ways of doing (practices) and the ways of organising (structures). Widely sharing this knowledge can help explaining deficits in meeting social needs and highlight the leverage points for desired transformative change.

10. Centralised knowledge and power

Whilst formal institutions are critical levers for systemic change, monopolised and centralised knowledge and decision-making impedes transformational change. This goes for government agencies, academic institutions and among actors in the private sector. Rather, to foster transformative change and to facilitate deep cultural change including shifting mindsets and values, centralised knowledge and power structures should be complemented by knowledge systems that are distributed, co-produced and shared among actors, and decision-making processes that are diversified, inclusive and span across multiple levels, scales and sectors. An inclusive process also

acknowledges the value-laden and political nature of climate change adaptation, as well as the limited potential of current institutions to deal with this challenge (see Chapter 1).

4. Challenges and Opportunities for Just Transition in Regions4Climate

In Regions4Climate, 12 regions strive for climate resilience. Each of the 12 regions has a unique set of opportunities and challenges in the just transition to climate resilience. These regions are located across Europe in different climatic areas. They differ considerable in terms of size, population, environment, and socio-economic conditions, and include coastal regions, cross-border regions, and archipelagos. Each region is exposed to specific climate change impacts and people are vulnerable to these impacts to different degrees. At the same time, regional decision-making processes are more or less participatory and more or less aware of climate resilience needs of different societal groups. Also, current governance and administrative setting can be conducive to transformative process or slow down transformation.

The regions are already testing and implementing climate resilience innovations (e.g., in WP5 of Regions4Climate) and may have further reaching visions on how to improve regional climate resilience. These activities should be scrutinised with respect to social justice and transformative climate change adaptation.

In this section, we provide a brief overview of potential challenges and opportunities to promote adaptation justice and transformative action aimed at building regional climate resilience. The information presented here is based on the screening of the information available in the regions' descriptions in the Description of Action of Regions4Climate, the project deliverable "Social vulnerability in R4C demo regions - Regional indicators and narratives", and the Stakeholder Mapping performed as part of communication and dissemination activities in Regions4Climate. The regional screening was performed in line with the justice dimensions and transformation enablers and barriers presented in chapter 2 and chapter 3 respectively. For each region, we analysed the information about the current conditions and planned innovation actions from the perspective of recognitional, distributional, procedural, and restorative justice as well as the eight transformation enablers and two barriers. It has to be, however, recognised that the innovation actions in the context of Regions4Climate can cover only partially the steps necessary for an entire region to become climate resilient.

This regional screening can serve as a starting point for the just transition roadmap process outlined in the following chapter. It cannot replace or anticipate any of the steps described in the following chapter.

4.1. Basque Country

The Basque Country is described as a region with low vulnerabilities when compared to the other 12 case regions. The most notable vulnerabilities are its high share of elderly citizens (>70 years) and high unemployment. In contrast, Basque Country is characterised by the highest income in Purchasing Power Standard (PPS), low poverty index, a significantly lower unemployment rate compared to the national average, and high life expectancy. It is an

advanced region considering its deep knowledge of vulnerability to climate change and the region's robust governance structures and coordination at regional and local administration level.

Climate change can aggravate the already existing challenges related to water, energy, environment (including biodiversity) and infrastructures. At the local level, sectors and stakeholders most affected by climate change and the transition process are the fishing sector, people practicing water sports and enterprises related to coastal ecosystems, natural heritage, as well as research, technology and educational organisations, natural and infrastructure managers, and local and regional authorities.

Currently coastal areas are likely to experience the greatest impact of extreme climate change events (where 3 out of every 4 people live). This impact may result in the loss of biodiversity, degradation of some transport and water infrastructures, and other economic sectors (distributive justice). People living, working or enjoying the coastal area are likely to be most affected. An awareness of *procedural justice* is demonstrated through concerns regarding local stakeholders' engagement and the activation of the private-public ecosystem.

The region's proposed Innovation Actions will focus on an integral restoration of estuaries, management tools for monitoring and forecasting, policy for a transformation and improved stakeholder engagement.

As part of the Innovation Actions the Basque Country will focus on working with local stakeholders and activating regional private-public ecosystems, identifying stakeholder communities most affected by climate change and the transition process, and clustering and coordinating agents for the development of complementary climate change adaptation actions. These activities affect *distributive and recognitional justice.* An example of *procedural justice* is the plan to develop a systemic co-creation methodology to build and strengthen adaptation solutions for just resilience. The co-creation process will aim at increasing the sense of community ownership and increase local acceptance of the transformation process; a demonstration of *restorative, distributive and procedural justice.*

Transformation enablers in the region are numerous and include an appropriate legislative framework and specific action plans for climate and energy transformation (Climate Change Strategy of the Basque Country to 2050) and the adoption of several best practices and solutions from other programmes and a multiscale, multisectoral regional pathway to climate change adaptation for decision making in the Txingudi Investment Plan. Further enablers include investments for the restoration of Txingudi Bay, including several improvements in biodiversity and recovery of ecosystem services and concerned local citizens.

Transformation barriers include the complexity involved in integrating the points of view of different groups and sectors with conflicting interests the lack of horizontal mainstreaming of resilience and climate change adaptation into urban planning and development in all sectors and a lack of trust between citizens and authorities; especially when it comes to participation and involvement of civil society and the awareness of economic sectors.

4.2. South Aquitaine

The South Aquitaine region has relatively high PPS, relatively low unemployment rate and high level of tourist arrivals when compared to other case regions. These indicators point to fairly good social and economic conditions. Economic activities in the region centre around the maritime and fishery industry, as well as coastal tourism.

Climate change poses a significant threat to the South Aquitaine region because of its wide oceanfront, concentrated coastal urbanisation, and the significance of a local maritime economy.

In terms of *recognitional justice*, there is an acknowledgment of a high percentage of elderly citizens in the region who need to be given special consideration. Furthermore, the fact that the maritime and fishery sectors, as well as those living on the coast are considered particularly high risk, represents challenges related to *distributional justice*.

Although currently, the needs of these at-risk sectors are only represented through elected officials, in the *transition process* there are plans to involve stakeholders through regional workshops and the “End-users Assembly" of the KOSTARISK joint lab.

The Innovation Actions for this region underscore the importance of accurate forecasting of oceanic risks. This entails real-time, remote monitoring of oceanic conditions and the development of more sophisticated oceanic models. The collected data will serve as the foundation for a dynamic, adaptive management approach to the waterfront. This strategy includes spatial reconfiguration of the coastal region, encompassing protective barriers in selected areas and targeted re-naturalisation and retreat efforts in others. The barriers under test include both man-made options such as detached breakwaters and natural cliff barriers that demonstrate potential for reinforcement with natural materials.

The major *enablers of transformation* are the technical monitoring solutions which would allow administrators to make informed, dynamic decisions and strike a compromise between protecting people, preserving local economy and respecting natural processes. The proposed participatory processes can also be seen as *enablers of transformation*. However, the South Aquitaine region's relatively small size in relation to the broader territory may lead to the marginalised status of vulnerable groups, potentially posing a challenge to their integration into the overarching national strategic framework. Lastly, the centralisation of decision-making at the national level, coupled with the limited participation of citizens, especially at the local level, represents a *barrier to transformation* and a challenge for *recognitional justice*.

4.3. Azores

The Azores are an archipelago in the North Atlantic relying strongly on agriculture, fishery, and tourism. Climate change can aggravate the existing challenges related to land use, biodiversity, water, and coastal erosion and can have a strong impact on the main economic sectors.

The Azores region's Innovations Actions aim at tackling these issues by increasing citizens' and stakeholders' climate change literacy and awareness and by launching digital tools for data collection and vulnerability assessments, focusing on facilitating decision-making processes and fostering the active engagement of citizens and stakeholders in these processes.

At the outset, the Azores have a high share of persons at risk of poverty or social exclusion, with a low level of education compared to other Regions4Climate areas. Both factors can be seen as indicators for challenges related to *recognitional and distributional justice*. *Distributional justice* can be further at stake when agriculture and tourism compete for the same limited resources.

In the transition process, the Azores highlight the need to include a wide variety of actors as co-producers of knowledge and as participants in the decision-making processes. In addition, the developed digital tools should be as accessible as possible. This contributes to *recognitional and procedural justice* in the transition process to climate resilience. At the same time, this task could be challenging, because currently, in this region, people use the internet to interact with public authorities less than in most regions in Regions4Climate.

As participation and inclusion are generally recognised as *transformation enablers*, the Azores' intention to involve many actors can support the transition to climate resilience. Also, the autonomy status of the Azores can be an *enabler*, as it allows for more flexible reactions and considering local needs. On the other hand, strong top-down decision making in the region can act as a *barrier*.

4.4. Tuscany

Tuscany is the most populous region of the Regions4Climate cases. It has one of the lowest percentages of children under 15, the highest percentage of inhabitants over the age of 70 and more than a third of households are single households. The region also experiences low rates of digital interaction with authorities. However, the region also exhibits the lowest rate of severe material deprivation, a lower rate of unemployment when compared to the country average, and a high share of population with at least lower secondary education levels.

Beach erosion and sea level rise present significant challenges to agriculture and coastal habitat preservation. The region's Innovation Actions centre around the prevention of coastal erosion in the Municipality of Piombino using Nature Based Solutions (NBS). The proposed actions seek to include extensive modelling, the building of scale models, in-situ experimental prototypes and monitoring of the area using sensors and satellite imagery. They commit to making the collected data available through an open-source data platform. The proposed NBS will be modular to improve the chance of replicability in similar regions. There is also mention of improving energy efficiency of public buildings and improving bicycle networks as part of a focus on sustainable mobility.

Procedural justice is present in the consultative processes which included local stakeholders and assisted in creating buy-in for the proposed NBS. This approach will continue into the design and implementation of the NBS by including co-design workshops with various citizens associations. The coordinators of the Innovation Actions

note the importance of well-structured participation activities that create the opportunity for collective choices with operators and citizens, especially in light of a noted lack of confidence in public choices.

Recognitional justice is addressed l by asserting that promoting integrated social, economic and environmental development is required to fight against poverty and increase social inclusion. This is further emphasised by the intention to continue the support of integrated local strategies, such as the access to social, educational and employment services.

The intention to include a cost analysis that would account for socioeconomic damages faced by a large group of stakeholders (including farmers, beach clubs and civil society) can contribute to *distributional justice*.

Transformation enablers include the region's favourable regulation that encourage participation in innovation projects and the plans to involve local communities in the maintenance of the NBS through job creation.

Barriers to transformation include low levels of digital engagement, which might create challenges in creating citizen engagement with the open-source data, and the proposed digital tools that are aimed at increasing participation. Also, a noted lack of faith in public decision making can potentially hinder the creation of joint visions and participation.

4.5. Køge Bay

The Køge Bay region covers 11 municipalities and has a population of approximately one million people. It has by far the highest population density among the 12 case regions. The region has a high share of single households, but the share of elderly citizens is relatively low. The population is generally well-educated, the employment rate is high and there is a very high level of digital access to public authorities. The poverty rate is equal to the national average and primary industries only have a marginal role in the local economy. From a regional perspective, Køge Bay is anticipated to be among the least socially vulnerable regions in Regions4Climate.

In the Køge Bay region, the main impacts of climate change relate to water and the risk of pluvial, fluvial and coastal flooding. Geographically, the region is a low-lying flat plain with a 40 km coastline. Referring to the EU Flood Directive, the Køge Bay region is the area with the highest flood risk in Denmark. This is due to very high flood impact costs resulting from the high concentration of people, buildings, and infrastructures in the Køge Bay area.

The region demonstrates a high level of ambition concerning stakeholder engagement, involving the public and private sector as well as civil society. The proposed Innovation Actions include co-creation processes, workshops, raising awareness through group education and the application of tools (including Augmented and Virtual Reality (AR/VR)) that enable more citizens, decision-makers and other stakeholders to be prepared and take action in relation to climate change. Hence, the aim of the region is to build social resilience to climate change, specifically to build social resilience to dynamic coastal changes. In addition, the Køge Bay region aims to improve policy integration and collaboration across administrative boundaries, and to explore the wider potential of 'non-structural'

innovations as a climate adaptation measure (i.e., solutions in the social realm rather than in terms of technological infrastructure).

In combination, the Køge Bay region demonstrates *recognitional justice* by emphasising socio-economically disadvantaged groups in particular municipalities within the region. In terms of *distributive justice* between regions, Køge Bay is the area with the highest flood risk in Denmark and hence, flood impact mitigation and climate adaptation actions in this region is particularly important from a national perspective. The multi-stakeholder engagement and the adoption of AR/VR-tools to enhance citizens' participation and preparedness in the process of building climate resilience contributes to the promotion of *procedural justice*.

Transformation enablers that are already in place include practical experiments, the allocation of funding, community empowerment, participatory decision-making and distributed knowledge and power structures. *Barriers to transformation* might include path dependency, the lack of shared goals and limited knowledge of worldviews among individual and institutional stakeholders.

4.6. Burgas

Among the 12 project regions, Burgas is one of the regions with the highest poverty, lowest income rate, lowest lifelong learning, lowest life expectancy at birth and the highest employment in primary sectors susceptible to climate change impacts (forestry, fishery, agriculture).

Burgas is in close proximity to wetlands and experiences a number of climate-change driven risks, related to flooding, air quality, as well as heat stress exacerbated by the Urban Heat Island (UHI) effect. Floods pose a threat to a significant part of the city with direct impacts on citizens' health and local infrastructure. Additionally, floods have impacts on food production, more specifically, for crops grown for commercial purposes as well as household sustenance. Two districts — Gorno Ezerovo and Dolno Ezerovo — are built below the sea level in close proximity to the coastal lake Burgas and are thus at increased exposure to harmful impacts of flooding. The exposure is exacerbated by an insufficient stormwater sewage capacity. Floods also pose a threat to local ecosystems in terms of equilibrium disturbance as well as run-off carrying harmful substances such as fertilisers and pesticides. Urbanisation exacerbates threats to local ecosystems and environmental degradation. Burgas is also characterised by lack of green areas (decreased natural run-off during floods), combined with a thick road network, adding to the urban heat island effect. Additionally, Burgas has high air pollution rates (particulate matter concentrations), which is also exacerbated by climate change and UHI.

As a result, the groups of population with high social vulnerability factors are also exposed to a number of climate-change hazards, and are at risk of negative health impacts, impacts on economy, sustenance and livelihood as well as dwellings, infrastructure and ecosystems.

The Innovation Actions planned in Burgas include the integrated management of Burgas wetlands, smart and climate resilient city and urban ecosystem and social resilience enhancement.

Considering social vulnerability, hazards and exposure, it is pertinent to note the disproportionate burden of risk of some communities, such as e.g., farmers in flood areas. From the perspective of *distributive justice*, there is an understanding of uneven distribution of risks due to livelihood dependencies, limited financial resources or inferior housing quality. Rural dwellers, especially those with livelihoods in the agricultural sector will benefit from early warning systems and overall digital and technological improvement of flood risk management. Agriculture, as per the case description, is a vulnerable sector. While technological and digital flood risk management solutions will benefit it in terms of evacuation and preparedness, these might not reduce the risk of floods for soil and water quality having negative impacts on agriculture and livelihood.

With regards to *procedural justice*, there are concerns with regards to the low level of citizen participation in addressing climate challenges. The need for successful interaction of communities and local administration is growing in areas at risk. This concern is also a *barrier to transformation*, and thus needs to be addressed to enhance the impact of the innovation package. More specifically, to *enable transformation* there is a need to enhance the interaction between communities and administrations as well as to consolidate the shared vision and trust among the public bodies to deliver adaptation and address citizens' needs appropriately. The absence of shared vision and belief in climate adaptation and resilience as a cross-cutting effort demanding urgency and coordination has been voiced as a concern. The Innovation Actions propose addressing this issue of community engagement in the innovation 2 Green Bridge. This innovation is currently mainly focused on urban dwellers, and, in consideration of *procedural justice*, the possibilities of engagement of rural dwellers could also be explored.

There is a lack of recognition of climate change as an urgent and systemic issue at the government level, resulting in the lack of cross-cutting effort that would unite environmental, social, and economic efforts – this is a *barrier to transformation* Further *barriers* include a lack of awareness of horizontal mainstreaming in resilience building at political, strategic, and operational levels.

4.7. Uusimaa

In terms of vulnerability, Helsinki-Uusimaa has one of the most favourable conditions in the case regions. This is largely due to the extremely low levels of severe material deprivation, high rates of education and lifelong learning, and the lowest rate of persons at risk of poverty or social exclusion in the case regions.

In this project, the Helsinki-Uusimaa case focuses on climate resilience to the impacts of pluvial flooding and urban heat through a "human-centric digital twin" approach characterised by engagement with a variety of stakeholders, ranging from citizens, to NGO's, to experts. Through this human-centric approach, the Helsinki-Uusimaa case aims to address climate risks in the region.

There are clear issues of *recognitional justice* in the Helsinki-Uusimaa case, both presently and projected for the future. Segregation and migration have been raised as major challenges to resilience planning in the region due to increased vulnerability among migrant groups. Similarly, there is a concern about planning processes primarily considering the "regular citizen", who is perceived as a "white, middle-aged male". The involvement of vulnerable groups in the planning process is difficult, because there is little flexibility to move away from this generic target

demographic. Project partners aim to address these issues of *recognition* by consulting a wide variety of stakeholders from a wide variety of backgrounds throughout the region, asking how they perceive natural environments and how that impacts their sense of personal and community wellbeing. With regards to *procedural justice* in resilience planning in the region, there are plans for extensive stakeholder engagement through a variety of participatory processes. The aim is to involve stakeholders throughout the digital twin development process to better understand their preferences relating to green space, especially in their own neighbourhoods. Additionally, experts will be involved throughout the process. Regarding *distributive justice*, Helsinki Metropolitan Area conducted a social vulnerability mapping in 2015 (Kazmierczak, 2015), while the mapping of the whole Uusimaa region has not been carried out yet.

The Innovation Actions aim to test the digital twin in "regeneration areas" of Helsinki in geographically diverse areas, including a comparison between rural and urban neighbourhoods), advancing the understanding of risk and adaptation *distribution* and identifying the needs of possible compensation. To aim further, the innovation can go beyond geographic divides by thoroughly accounting of the distribution of the harms and benefits of climate hazards and responses.

Transformation in this region will be *enabled* by the emphasis on participatory processes and "action-ready knowledge". Critically engaging with a broad array of stakeholders can promote shared visions and goals, community empowerment, participatory decision-making, and monitoring actors' everyday practices. Similarly, creating action-ready knowledge requires close collaboration with practitioners of policy and planning to understand what type of knowledge is needed and how it can be transferred to promote effective resilience building. This necessarily involves practical experiments with real world data and the support of practitioner bodies in the form of funding and/or regulation. Strong path dependency, centralised power and knowledge, as well as primarily unidirectional adaptation planning policies can act as *transformation barriers* for this case.

4.8. Pärnumaa

Pärnu County faces a number of *climate change hazards*, including storm-induced floods and erosion, both aggravated by global sea level rise, severity of winter storms and decline of winter ice coverage. As it is a low coastal region, it is prone to storm surges both in the rivers and in the coastal area. Furthermore, landslides pose a threat as a consequence of erosion and soil changes. Considerable efforts on reducing flood risks have been or are being undertaken in the region, including early warning systems for storm surges, amendments to regional planning standards, monitoring of land improvement systems, and other engineering solutions. Another need identified is the mitigation of UHI effect. Groups, areas and sectors vulnerable to heat and drought include rural areas and agricultural SMEs.

The Innovation Actions proposed in the project are related to UHI mitigation through urban planning, design and tools, as well as to decreasing risks of landslides through modelling and engineering solutions in areas susceptible to land-slides. More specifically, the project will enhance the understanding of urban heat, floods, coastal erosion, and landslide dynamics through mapping, monitoring and modelling to inform regional and land use planning. Adaptation measures including a green index will be systematically integrated.

With regards to the justice dimensions, there are currently concerns with regards to *distributive and recognitional justice* manifesting in the absence of a social vulnerability assessment in the region within the preparation of the regional Sustainable Energy and Climate Action Plan 2030 (SECAP). More specifically the impacts of climate change on vulnerable people have not been assessed; neither are there currently indications of plans to reduce vulnerability. There are also concerns on *procedural justice* voiced in relation to the shortcomings of stakeholder inclusion in the preparation of the SECAP. Project innovations such as practical experiments have the potential to *enable transformation* towards climate resilience in the region, secured by dedicated funding for their launch.

4.9. Crete

Among the 12 demo regions in the Regions4Climate project, Sitia in Eastern Crete has the highest unemployment rate, the highest proportion of the population employed in primary industries (agriculture, forestry, fishing), and the highest proportion of tourist arrivals relative to the local population. Furthermore, the region is at high risk of poverty, and has the second highest material deprivation rate and the second lowest level of participation in lifelong learning among the 12 case regions. The main impacts of climate change on Sitia are expected to be drought, water scarcity and biodiversity loss, and to a lesser extent cloudbursts, forest fires and coastal erosion.

The groups impacted by climate change are predominantly referred to by sector (agriculture, tourism) or sub-system (biodiversity, cultural heritage), which reflects *distributional justice*. Vulnerable groups are not specifically mentioned in the regional climate adaptation plan, as the social support structures are largely within the domain of public social services rather than the more technically and environmentally oriented climate adaptation plan. So, in relation to just transition for climate adaptation the *recognitional justice* dimension is strong when it comes to sectors affected by climate change, but weak in the specific focus on vulnerable groups. This has a spillover effect on *procedural justice* with a weak representation of vulnerable groups in the current regional climate adaptation plan. However, *procedural justice* is highlighted in the regional Innovation Actions with the development of a digital twin for the region and an app to reach remote communities.

The impact of climate change on public health is acknowledged in the regional Innovation Actions, along with the potential of linking climate adaptation to wider sustainable development, expanding the climate-energy-water-food nexus to also include ‘society’ (i.e., a climate-water-energy-food-society nexus), and to emphasise the role of female entrepreneurs, cooperatives, education and cultural heritage in just adaptation.

In terms of *transformation enablers*, it is envisioned that the Innovation Actions in Eastern Crete will help improve the coordination of local/regional policies and citizen engagement and collaboration with academia. Furthermore, participatory processes with local stakeholders are emphasised to build knowledge on water resources management. In combination this reflects a process with practical experiments, learning loops, supportive funding, acknowledgement of best practices, community empowerment and participatory decision-making which are all considered to be *transformation enablers*.

The most influential and impactful stakeholders are assessed to be the public authorities and the policy makers along with the general public, whereas research institutions have the lowest level of impact and influence on

systems change in the region. The process of implementing the GEOPARK lighthouse is described as starting from decision makers and moving to the economically active population and tourists, which can be interpreted as a somewhat centralised approach, though the ambition is to involve “all stakeholders” and “empower vulnerable populations”. Centralised power could be a *barrier to transformation*, but this issue is already addressed in the region.

4.10. Castilla y León

From the vulnerability analysis, Castilla y León is one of the regions with an unfavourable condition in several indicators: low density and high population decline (especially in rural areas and even in small traditional towns), high share of elderly (70 or older), high unemployment (but lower than the country average), high share of persons with lower education levels and high employment in agriculture.

Currently, the situation of Castilla y León can be described through a number of factors. Firstly, a rural vulnerability to climate change, whereby the large and dispersed population in the region, with a low population density, makes it challenging to implement and manage effective climate change adaptation strategies. The region's aging population may have limited capacity to adapt to changes, hindering the implementation of new measures. The male-dominated nature of rural areas may affect the inclusivity and diversity of adaptation efforts, potentially overlooking the unique vulnerabilities of women in climate change impacts, hence posing a challenge for *recognitional justice*.

The Castilla y León pilot will address the problems associated with climate change as a catalyst for depopulation and loss of opportunities. To this end, the transition towards a sustainable agricultural production model is pursued, which allows for an efficient use of resources. Furthermore, it is proposed that this model should generate an economy with an extensive network that is rooted at a local level and that generates added value in the same region. The proposed Innovation Actions aim to promote the implementation of economic activity in rural areas to fight against depopulation, reviving rural landscapes and sustainable food systems. The Innovation Actions include steps towards inclusive and just transition and environmental justice. The pilot will improve two production centres in Segovia that integrate greenhouse vegetable and nursery plant production with a specific approach on circular economy and NBS ensuring the environmental sustainability of the production model. At the same time, the proposed Innovation Actions aim to establish strong relationships among local businesses through the implementation and testing of a green and social business model, including regional training to foster entrepreneurship and cross-border cooperation in order to improve climate resilience.

The region depends on agriculture as the main economic driver which makes it susceptible to climate-related challenges such as drought and high temperatures, leading to reduced production and limitations on certain crops. The rural population's low adaptive capacity is a *barrier to transformation* and the adoption of innovative measures, such as new irrigation systems for crops better suited to changing conditions. The aging demographic exacerbates this challenge, as older individuals may face difficulties in embracing and implementing new agricultural practices and technologies.

Maintaining a comprehensive infrastructure of services across the vast and sparsely populated territory is another *barrier*. This limitation includes challenges related to transportation, communication, healthcare, and other essential services. The inadequate infrastructure may impede the implementation of adaptive measures, hindering the region's ability to respond effectively to the impacts of climate change. Lastly, there is a certain disconnect between the different chains of authority, citizens and farmers, which to some extent discourages entrepreneurs from starting new businesses in the area.

4.11. Nordic Archipelago

The Nordic Archipelago is a large cross-border region spanning from Östergotaland in Sweden, covering the Åland islands and extending all the way to the Kymenlaakso region in Finland. The region is characterised by low population density (less than 100 inhabitants/km^2), and a high share of single households (30%), low numbers of doctors and notably high rates of tourist arrivals in the summer season.

The region is simultaneously at risk of the pressures of climate change and rural depopulation. Interview respondents highlighted the challenge in motivating working age population to stay in rural parts of the region, especially in the agriculture and forestry sector.

The Innovation Actions will focus on renewal of transportation systems and the interlinked energy systems to enhance inter-regional cooperation. The aging transportation system, which is put under pressure during the high tourism season, is in need of modernisation. However, in order to translate this renewal to inter-regional cooperation and other socioeconomic benefits, there is a need to quantify the links between key sectors in the region. The proposal focuses broadly on two main activities: modelling and visioning. It starts with modelling the risks of climate change, the impact of transport renewal and developments in energy production and energy efficiency. Then it proposes linking these models to visioning exercises, which would encourage authorities and local citizens to imagine improved liveability of the region, and a Vision and Action Plan for sustainable transport and energy systems, which can act as a *transformation enabler*.

Lastly, there is an emphasis on establishing inter-regional governance structures, which includes incorporating a cross border company to administer transport issues across the region, as well as a working group for energy and transport that would utilise standardised workflows that increase collaboration and prevent duplication of work within Swedish, Åland, and Finnish political jurisdictions.

The development of this working group, which would include diverse stakeholders including citizens, local businesses, environmental protection bodies and government agencies, can contribute to *procedural justice*.

However, the complexity of aligning multiple state jurisdictions to facilitate the renewal of energy and transport systems, as well as the heterogeneity of those jurisdictions' needs and demographics, presents significant *barriers to transformation*.

4.12. Troodos

The Troodos region is a sparsely populated (below 100 inhabitants /km^2) inland locale of Cyprus. While the available data represents the whole of Cyprus (which is characterised by generous coastal areas, and 14% of GDP generated from tourism), the Troodos region is an outlier in that it is mostly inland, rural and accounts for only 3% of the Cypriot population.

Climate adaptation plans for the region focus on regenerative, inclusive and climate neutral tourism. Innovation Actions include community dialogues to define a vision and a plan for such a tourist region, providing training and support for local tourism related businesses (e.g., restaurants, accommodation and handicrafts) including improving energy efficiency and waste management, as well as creating business models for linking these activities to ecosystem regeneration. Lastly, a multi-stakeholder “Destination Management” board will be formed to oversee these activities.

Although direct mention of vulnerable groups in the plans are sparse, representatives spoke of *recognitional justice* as common, implicit knowledge. Leaders mentioned that it was clear to them which villages and individuals are vulnerable. Furthermore, there is mention of the need for socially inclusive development and plans to focus the renewal of the tourism sector on young and female entrepreneurs.

Involving community members in the visioning and planning of the tourism renewal, as well creating a management board made up of diverse stakeholders, to some extent represents *procedural justice*.

Transformation enablers include a “short distance” between citizens and decision makers, referring to the small geographical size of the region, and the fact that decision makers and citizens know each other well. At the same time, this intimacy could result in established and hard to overcome power dynamics, and the lack of formality may lead citizens and decision makers to overlook the need for official forms of representation. Another *barrier to transformation* is the almost singular focus on tourism development, and as a result, a potential lack of attention to other important issues and sectors.

5. A Roadmap Process

Roadmaps are an instrument to lay out and orchestrate actions that serve a specific goal or vision among a broad range of stakeholders within a given time horizon (Antuña-Rozado et al., 2016; Miedzinski, Mazzucato, et al., 2019). They can function as a catalyst for transformation via a common vision, by a enabling a better understanding of the interdependencies of political, sociocultural, economic, and environmental factors, and overcoming system lock-ins that cannot be tackled otherwise, e.g., by market mechanisms (Ahlqvist et al., 2012). The scope of roadmaps can range from specific innovations or well-defined challenges, sectors, subsystems to far-reaching societal changes and transformations (Ahlqvist et al., 2012; Miedzinski, McDowall, et al., 2019).

In the context of Regions4Climate, the jointly recognised need for transformative action towards regional climate resilience is the rationale for the just transition roadmaps. This rationale translates into region-specific transformative visions, clearly defined goals of the roadmaps, and a set of actions paving the way towards these goals. This means the roadmap provides a detailed short- to mid-term perspective aligned with a long-term transformative vision. This roadmap process will be implemented and tested in the 12 regions of the Regions4Climate project.

The focus on just transition to climate resilience guides the content of the roadmaps and the of their development. The content of the roadmaps should support distributive and restorative justice by addressing and reconciling the uneven distribution of climate change impacts caused by differential exposure and vulnerabilities (unequal burdens). It further safeguards that adaptation actions and actions towards climate resilience are inclusive and do not exacerbate existing disparities or create new ones (leaving no one behind). The roadmap process adheres to recognitional and procedural justice, which is reflected in each of the steps described below and utilises and fosters regional transformation enablers and aims at lowering and overcoming transformation barriers.

This chapter outlines essential steps to build an actionable, region-specific roadmap for just transition to regional climate resilience. The roadmaps will support regions to integrate regional adaptation projects with local investment projects to ensure an inclusive, transformative process and avoid or remediate any negative impact on local communities.

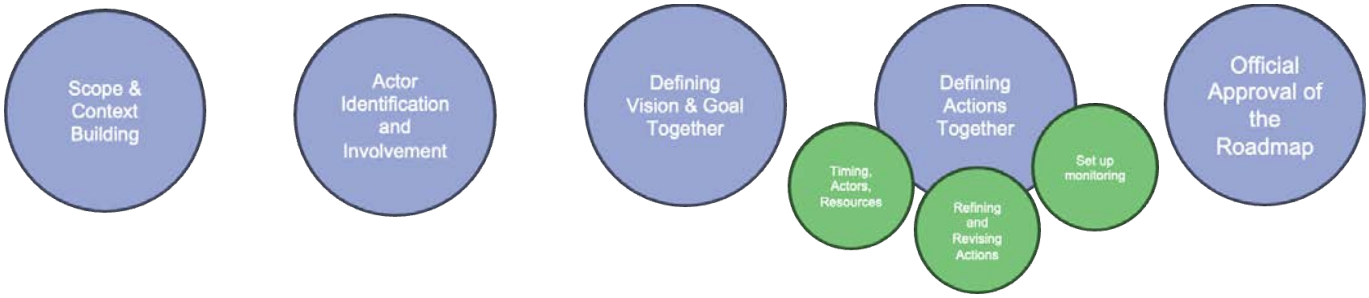

Figure 5. Five steps of a roadmap process for just transition to climate resilience

The roadmap process outlined below includes five steps (Figure 5). These steps are presented in a logical order. In the practical implementation, some steps can be performed simultaneously and iteratively since outcomes of a logically later step will require the revision of earlier steps. In each step, the rationale of a just transition to climate resilience is associated with specific expectations for social justice and transformation. We outline these expectations in the table below (Table 3).

Table 3. Justice and transformation considerations at each step of the roadmap process

	Recognitional Justice	Procedural Justice	Distributive Justice	Restorative Justice	Enabling Transformation
Scope & Context Building	Does the collected background material adequately reflect the climate change challenges for different groups (including vulnerable and marginalised)?	Is the context building process well documented? Is the background material accessible?	Did we recognise the (unequal) distribution of climate change risks?	Is there information about already incurred climate-related harm and damage?	Does the level of intervention correspond to the leverages that are accessible to the involved actors?
Actor Identification and Involvement	Did we identify all actors vulnerable to climate change including those that currently do not have a voice? Did we identify marginalised groups at risk to be negatively affected by climate change?	Is the roadmap process accessible for all relevant actors?	Did we identify all actors affected by climate change? Did we identify those actors who potentially have to implement and pay for climate change adaptation?	Is there information about the possible social, cultural, political or economic factors that may influence vulnerability of different stakeholders and actors?	Did we identify those actors that have a mandate to act and initiate substantive changes?
Defining Vision & Goal Together	Do all participants in the roadmap process have equal opportunity to express their needs and visions with respect to climate resilience?	Is the participation in the vision and goal setting process organised in a fair, transparent, equitable, and open manner, considering structural barriers to participation?	Does the vision and goal allow for a fair distribution of burdens and benefits, rights, and responsibilities?	Does the vision and goal reconcile pre-existing unjust distribution of burdens?	Are the involved organisations/actors ready to agree to a vision and goal that potentially changes their role and position in relation to other actors?
Defining Actions Together	Do the identified actions consider the needs of those vulnerable to the impacts of climate change and transition as well as of marginalised?	Is the process of defining actions transparent and inclusive? (avoiding jargon, accessible, no hidden agenda)	Are the burdens, costs and benefits of an action distributed in a just manner? Does the action potentially perpetuate old or create new vulnerabilities or inequalities?	Does the action contribute to the reconciliation of pre-existing unjust distribution of burdens? Is there a compensation, if an action causes unequal distribution of burdens and costs?	Does the action promote climate resilience at a systemic level? Does it potentially create new risks elsewhere (temporal & spatial)?
Official Approval of the Roadmap	Are the approving organisations committed to the entire roadmap?				Do the approving (or committing) organisations have the mandate and resources to implement the actions of the roadmap? Are there other ways to achieve broad and lasting support for the roadmap?

In the sections below, we explain in detail the purpose and goal of each step and suggest a set of applicable tools and methods. It is necessary that each step is adapted to the specific regional context and existing activities related to social justice and transition towards climate resilience be acknowledged during the roadmap process. In Regions4Climate, the just transition roadmaps should be aligned with the Innovation Actions in WP5, the Innovation Roadmaps in WP6, the Climate Resilience Maturity Assessment and the conceptual development for S4+ (macro-)regional strategies in WP4. Also, regional resources and capacities can have an impact on the extent and ambition of the roadmap process. Finally, this framework showcases only a small selection of tools and methods. How well the tools and methods are applicable depends on the regional settings. It can be advisable also to consider other sources of tools and methodologies.

The first step, "Scope and Context Building", provides the basis for the roadmap process. The initiators of the roadmap establish a core group of actors who collect relevant information about the region's climate challenges, policies, governance structures, and territorial characteristics, considering the overall rationale of transformative action towards regional climate resilience. The initiators also provide a preliminary scope for the roadmap, indicating the degree and level of systemic change the roadmap aims for.

The second step, "Actor Identification and Involvement", maps all actors and stakeholders that should be involved in the roadmap process within the given scope. This step will give special attention to marginalised and vulnerable groups. Beyond the mere identification of actors, the active involvement of these actors is equally important. Therefore, this step also considers incentives for participation and the accessibility and inclusiveness of the roadmap process.

The third step, "Defining the Vision and Goal Together", includes two major activities. In the first activity, participants create a vision together – an ideal state of climate resilience – within the scope of the roadmap. The second activity provides a narrower, shorter-term goal in line with the vision that considers the available time, resources, and capacities of the involved actors.

In the fourth step, "Defining Actions Together", the actors jointly define actions that facilitate the transition from the current situation to the goal defined in the previous step. Each action is assessed with respect to the uneven distribution of the burden of climate change, the principle of "leaving no one behind", and the dimensions of adaptation justice. Attention is given to the credibility of the suggested actions, so the descriptions of the actions should include, where possible, information about the timing, accountable and responsible actors, resources, and criteria to monitor the progress and success of the action's implementation. This step can also include an iterative element, where local stakeholders and experts assess such aspects as the action's effectiveness, costs, or acceptability. The actions can be adjusted and improved based on different types of knowledge.

The fifth and last step is the "Official Approval" of the roadmap. The commitment of actors accountable and responsible for the implementation of the roadmap and the transition process is essential for legitimacy and credibility (De Geus et al., 2022; Miedzinski, McDowall, et al., 2019; Olazabal et al., 2019). Depending on the scope of the roadmap and the involved actors, the commitment can be expressed by the approval of the roadmap by a (regional) public authority or by a publicly stated commitment by relevant actors with the necessary mandate and resources to implement the roadmap.

5.1. Scope and Context Building

The goal of the first step of the roadmap process is to map and understand the regional context in relation to the challenge that the roadmap should address. It provides the foundation for the following steps by collecting information and knowledge relevant to the roadmap process, by delineating a (preliminary) scope and time horizon, by securing the necessary resources, establishing a core group of actors and stakeholders, and by outlining the governance and organisation of the process (Miedzinski, Mazzucato, et al., 2019; Miedzinski, McDowall, et al., 2019). In Regions4Climate, the core group of actors includes at least one regional project partner and a facilitating project partner.

In this step, information collection is mainly a desk research exercise covering relevant strategies, policy documents, regulations and laws, statistical information and research results. The desk research can be enriched and deepened by interviews with regional representatives. This information is not only helpful to define the scope of the roadmap, but it also informs the goal-finding and provides a baseline against which the actions in the roadmap and the progress towards the goal can be compared. Relevant information can cover political, sociocultural, economic, and environmental aspects. It can further extend to technological and educational dimensions and other territorially relevant information.

The scope of the roadmap can be defined according to the level of intervention and degree of envisaged systemic change (Figure 6). The level of intervention can range from individual practices, policies, or technology via specific subsystems of sectors, up the entire societal system, paradigms, and mindsets (Meadows, 1999; Miedzinski, Mazzucato, et al., 2019). This relates also to the potential enablers, barriers, and leverages for change as described in Chapter 3. The degree of change can range from incremental adjustments to far-ranging systemic transformations (Heikkinen et al., 2019). Figure 6 illustrates the space spanned by the level of intervention and degree of change within which the roadmaps can be placed according to these characteristics. Obviously, the level of intervention and the degree of change are interlinked, and the latter also depends on the roadmap's goal (defined in the third step). Therefore, an iteration and revision of the scope can be advisable. In Regions4Climate, the planned actions and innovations in the regions provide some indication of the potential scope of the roadmaps. However, the scope of the just transition roadmaps should be derived from a broader regional context (not limited to the innovation packages only). Also, the time horizon of the roadmap should be considered in this step. In this context, the EU Adaptation Strategy's long-term vision of a climate-resilient society by 2050 and the implementation of the strategy's actions by 2030 can serve as benchmarks (European Commission, 2021b).

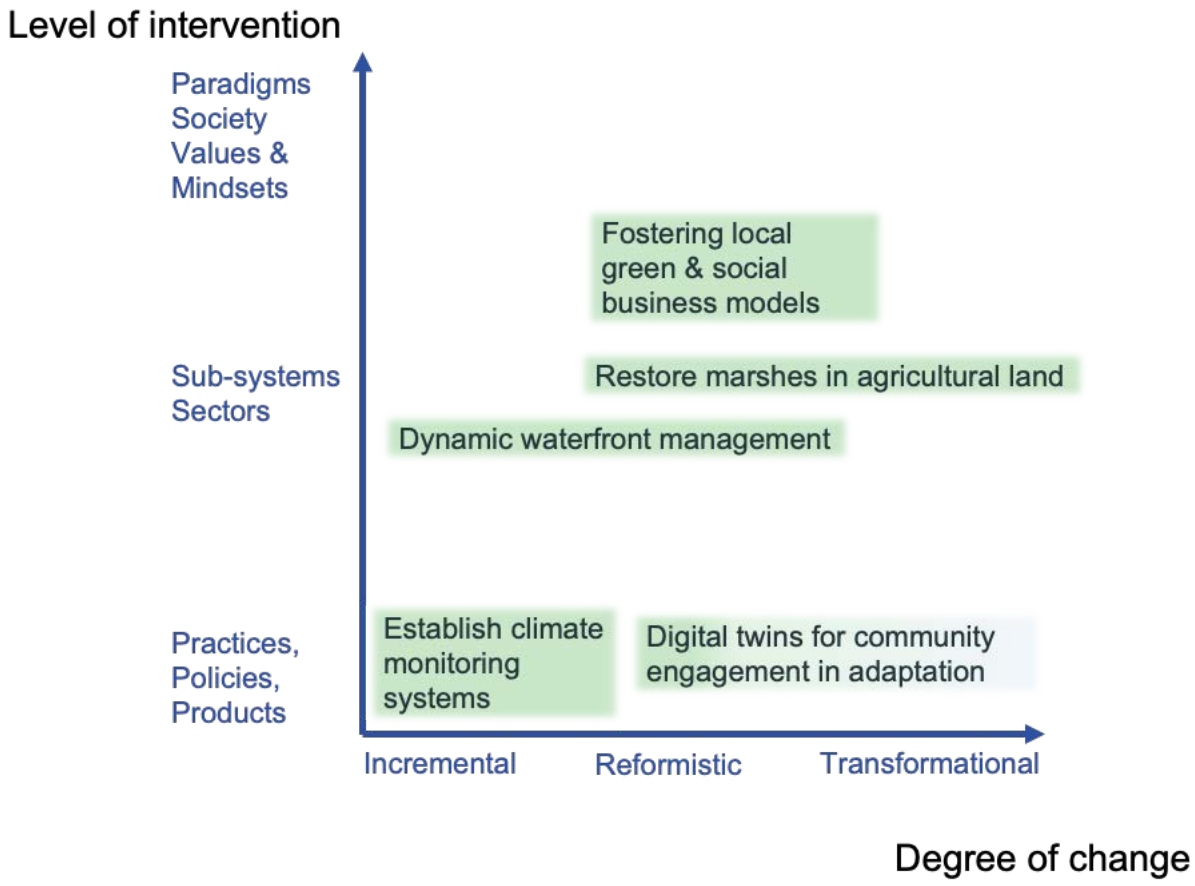

Figure 6. Level of intervention and Degree of change as descriptors of the roadmap scope including examples inspired by the Regions4Climate demonstrators (inspired by Miedzinski, Mazzucato, et al., 2019)

Alongside the scope and time horizon, the roadmap process needs an orchestrating actor and the necessary resources and structure. These are essential for the legitimacy and credibility of the roadmap process (De Geus et al., 2022; Olazabal et al., 2019). The orchestrating actor (or a core group of actors) has to ensure that a broad range of actors becomes actively involved with specific attention to marginalised and vulnerable groups; it should organise the execution of the roadmap process and coordinate the collaboration between the involved actors (Björk et al., 2022). In this step, identifying an orchestrating actor and process relevant resources does not pre-empt the actor involvement and mapping of necessary resources at later steps in the process but rather lays the foundation for these steps. Both are important for the transformative power of the roadmap and its long-term legitimacy (De Geus et al., 2022; Shi et al., 2016).

Regions4Climate provides substantial useful information to establish the context for the demonstrator regions, including the “Social and economic vulnerabilities analysis” (D2.1), the “Initial Climate Vulnerability & Risk Assessment” (D3.4), the “Climate resilience maturity assessment” (D4.2), and the “Governance recommendations” (D4.3), although some of the deliverables might not yet be available at the beginning of the regional roadmap

processes. The brief screening of the regions in Chapter 4 of this deliverable can serve as a starting point for the Scope and Context Building. Ultimately, the information retrieved from the sources mentioned above and the work done in this step should be summarised either in written or other forms, such as a challenge map (see Tools and Methods below) to be useful for the following steps of the roadmap process. This step should be conducted by the core group of actors, including the orchestrating actor of the roadmap process and a facilitating organisation.

In the following, we introduce a selection of tools and methodologies that can be adapted to the Scope and Context Building phase.

PESTE (+ C or + L) Framework

The PESTE Framework has been applied to comprehensively analyse and understand potential impacts of external factors on business activities or specific sectors (Song et al., 2017; Thakur, 2021). PESTE stands for Political, Economic, Social, Technological, and Environmental. It can be extended by a Cultural (C) and Legal (L). The current status can be assessed in these categories, and potential future scenarios along different time horizons can be laid out (Cipriani, 2022). This fits well to the forward-looking nature of a roadmap and the political, sociocultural, economic, and environmental spheres covered by the quadruple helix. Figure 7 shows a canvas template for a PESTE Framework.

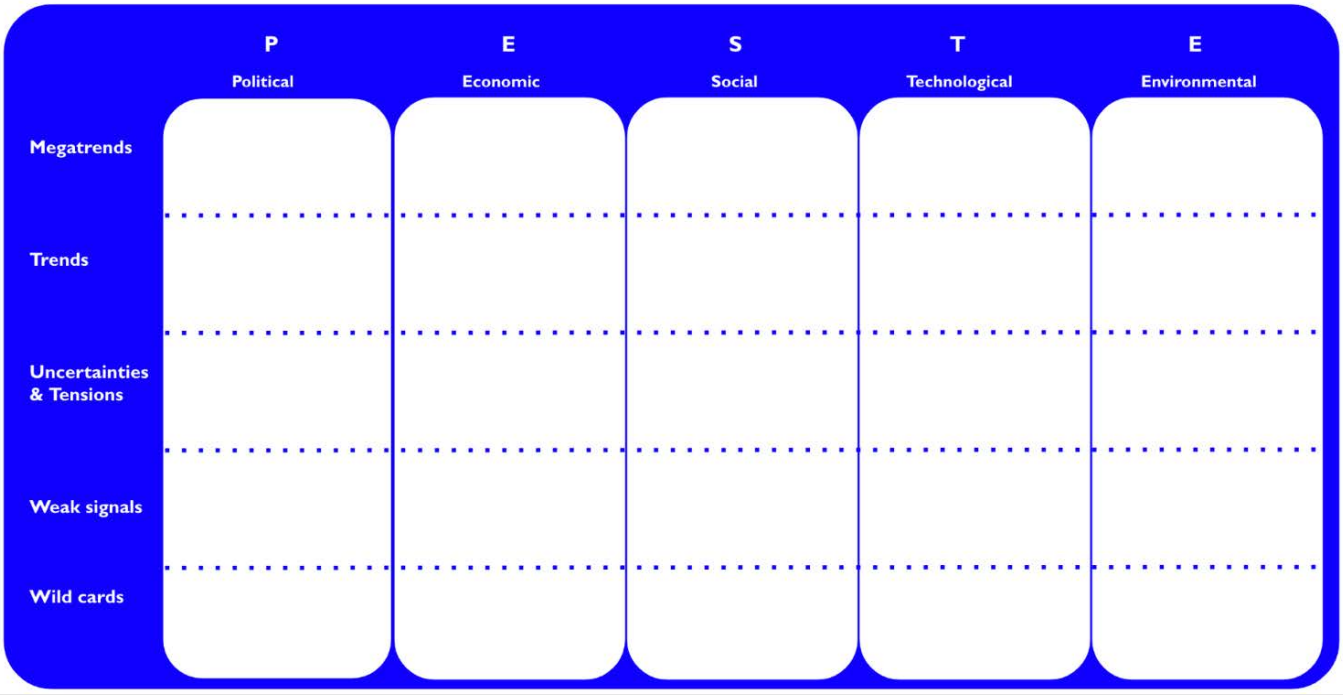

Figure 7. Example of a canvas for PESTE Framework

A more detailed description of the framework and suggestions for implementation can be found in the Knowledge Repository of the NetZeroCities project: https://netzerocities.app/resource-1558

Challenge Map

Challenge mapping supports conversations with experts who understand the complex challenge of just transition and could potentially contribute to overcoming the identified barriers. A ready challenge map can show how a particular transition challenge extends its reach across sectors and organisational borders, thereby requiring punctual and systemic interventions and even a specific sequencing of them. You can start by naming the 'sore points' where development is slow due to some barriers and then think of the aspects of the 'cure', i.e., the changes that would have a significant impact. The aim is to visualise the outcome to understand the 'anatomy' of the challenge – and preferably revise the draft with those who participated. The most ambitious visualisations may be close to pieces of art graphics, but more simple maps are often sufficient.

See, e.g., NetZeroCities https://netzerocities.app/resource-1148

Seven Questions Interview

The Seven Question Interview is a technique suggest by the UK Government to collect background information for futures thinking and foresight (UK Government Office for Science, 2017). It is a valuable tool at this stage as it helps to identify strategic issues to be addressed in the roadmap, stimulates individuals' thinking and can reveal potentially conflicting views. In addition, it can be performed with few resources. In an ideal case, two people perform the interview: One leads and one takes notes. The interviews are confidential, and all data protection issues must be considered (see Regions4Climate Deliverable 1.2 Ethics Plan).

In the interview, the following open-ended questions are asked:

1. What would you identify as the critical issue for the future?
2. If things went well, being optimistic but realistic, talk about what you would see as a desirable outcome.
3. If things went wrong, what factors would you worry about?
4. Looking at internal systems, how might these need to be changed to help bring about the desired outcome?
5. Looking back, what would you identify as the significant events which have produced the current situation?
6. Looking forward, what do you see as priority actions which should be carried out soon?
7. If all constraints were removed and you could direct what is done, what more would you wish to include?

Important themes to be considered in the roadmap can be identified based on how often specific issues arise in the interviews and how much interviewees stress their importance.

5.2. Actor Identification and Involvement

In the second step of the roadmap process the group of involved actors[1] is expanded beyond the core group that initiated the process in the first step. We already briefly addressed the need for a participatory and inclusive approach to the transition to climate resilience in the introductory chapter (Chapter 1). In climate change adaptation literature, the participation of citizens and the private sector and their different roles have been widely discussed (Castán Broto & Bulkeley, 2013; Fünfgeld & McEvoy, 2014; Mees et al., 2019; Taylor & Harman, 2016; Tompkins & Eakin, 2012; Wamsler, 2017). More recently, the involvement of vulnerable and marginalised groups (or the lack of it), its influence on the transformative potential and its relation to adaptation justice have received an increasing amount of attention (Bulkeley et al., 2013; Coggins et al., 2021; Goldman et al., 2018; Shi et al., 2016; Shi & Moser, 2021). At the same time, the success and credibility of the roadmap also depend on the involvement of those actors who currently have the mandate and resources to act on climate change adaptation (De Geus et al., 2022; Olazabal et al., 2019).

We first suggest some tools, processes, and best practices for identifying all relevant actors with a specific focus on those vulnerable to climate change. This is followed by examples of how to engage the identified actors in the process and keep them engaged along the different steps. A broad engagement is relevant in "Defining the Vision and Goal Together" and "Defining Actions Together".

In Regions4Climate, the results of the Governance Framework and Governance Recommendations developed in WP4 can provide useful information for relevant actors to be involved. The scope of the roadmap and the available resources also influence the breadth of the actor engagement.

1. **How to identify relevant actors with a specific focus on vulnerable and marginalized groups?**

To fully explain the condition of vulnerability, we need to assess it from social, political, economic, and cultural perspectives, which is why it is appropriate to consider it from an intersectional perspective. Based on earlier research, Anglada et al. (2023, p. 18-19) propose a broad summary list of factors that might increase the risk of the vulnerability of specific groups in transition policies and activities:

- Socio-economic status
- Geography
- Age
- Education
- Race, ethnicity, and religion
- Gender

[1] With the term actors, we refer broadly to all groups and individuals that contribute (or should contribute) to the roadmap process. I.e., we explicitly include also the vulnerable and marginalised groups who have a very high stake in the process but might not be the ones who actively implement adaptation and resilience building efforts.

These or similar categories are also used to map the vulnerability to climate change and natural hazards (e.g., Jurgilevich et al., 2021; Navarro et al., 2023). These assessments can provide first insights into the location of potentially vulnerable groups or territorial differences in vulnerability. However, for the roadmap process, we must be aware of specific individuals and groups in a specific context. In Regions4Climate, the authors of the report “D2.1 Social vulnerability in R4C demo regions – Regional indicators and narratives” relied on a similar set of indicators, including information on age, gender, income, education, and employment, to illustrate the regions' vulnerability compared to the other regions in Regions4Climate and the respective national average.

Anglada et al. (2023, p. 19-24) highlight that vulnerability can either be situational or induced. Situational vulnerability refers to inherent factors, such as homelessness or low education. In contrast, induced vulnerability is created by external factors, such as policies or, like in this project's case, climate change and resilience interventions. We focus here on the situational vulnerability that manifests in the exposure to climate hazards and the resulting climate risks as well as in the exposure to those actions tackling these risks, i.e., in the exposure to the transition to climate resilience.

Thus, we can use social, political, economic, and cultural conditions, personal factors, and exposure to either climate change or the transition to climate resilience as the constituents for a framework for assessing *who is vulnerable in the given context*. This identification process is illustrated with examples in Table 4 and Table 5.

Other relevant actors can be identified based on the following categories: researchers and scientific community; policymakers and public authorities; businesses, entrepreneurs and investors (as adaptors, financers or adaptation service providers). In addition, the actors in these groups can be categorised according to their interest in and influence on climate resilience. In Regions4Climate, this categorisation was used in a stakeholder mapping performed for each region at the beginning of the project.

In this roadmap process, the actor identification is conducted by the core group formed in the first step, "Scope and Context Building".

Table 4 and Table 5 provide a tool for identifying groups potentially vulnerable to climate change and to the transition to climate resilience. The identification process is, however, an open-ended process that might extend beyond these two tables.

Table 4. Framework for the context specific identification for groups vulnerable to climate change including two examples

Specific group vulnerable to climate change	**Climatic hazard** e.g., sea level rise, coastal erosion, storm surges, ocean warming, extreme storm events, floods, high temperatures, droughts, heat waves, water scarcity	**Vulnerability factor** e.g., socio-economic status, age, education, race, ethnicity, religion, gender, etc.	**Exposure**
People living in public housing	heat wave	socio-economic status	no cooling facilities in the apartment
People working outside in agriculture and construction	heat wave	Occupation	working outdoor
…	…	…	…

Table 5. Framework for the context specific identification for groups potentially vulnerable to the transition to climate resilience including two examples.

Specific group vulnerable to the transition to climate resilience	**Adaptation action** e.g., physical adaptation measures, changes in laws and regulations, provision of services, provision of information, organizational changes, provision of incentives	**Vulnerability factor** e.g., socio-economic status, age, education, race, ethnicity, religion, gender, etc.	**Exposure** e.g., legal obligations, financial burden, loss of income, exclusion
Farmers in coastal areas	Restoration of wetlands on land currently used for agriculture as means of flood risk management	Economic activity	Loss of agricultural land
Homeowners with limited financial resources in areas with increasing flood hazard	Adapted insurance premium for flood risk home insurance	Socio-economic status	Not enough financial resources to pay for an insurance or to move to another adequate place
…	…	…	…

2. Involvement of vulnerable groups in planning and implementing climate change adaptation interventions

An often repeated claim in participatory processes is that people from lower socioeconomic groups are "hard to reach" - whereas in reality, they may be "easy to ignore" (Anglada et al., 2023, p. 20). We want to avoid these kinds of patterns of exclusion when planning the interventions.

As mentioned earlier, vulnerability is a relational, dynamic, and contextual quality. As Downing and Patwardhan (2004) put it, this "diversity of the real world" must be a starting point for identifying and involving vulnerable groups. As no one-size-fits-all blueprint is available, this also underlines the importance of a genuinely co-creative process with local stakeholders and the groups in question. Such a process will ensure the most accurate possible knowledge of the context (and challenges, needs, and opportunities) is used in designing the adaptation measures and who to involve. This, again, requires time to get to know the local context and humility to listen to its people.

The collaborative roadmap creation process in Regions4Climate can borrow from the field of participatory design. In a broad sense, participatory design can be understood as a collaborative approach involving end-users (and those affected) in creating products, services and systems. It aims to create outputs that better meet the needs and

expectations of users and the ones affected by applying their knowledge and experiences (Interaction Design Foundation, 2023). Hence, the approach is also appropriate for Regions4Climate.

Building on the work of Hodson et al. (2023) on participatory design, a ”map of engagement” can be put together for the process. It provides a tool for thinking and defining who should participate and when in different phases and tasks of the roadmap process. Three main participant groups can be defined as follows:

1. *Core group of actors and people affected: In the context of Regions4Climate, this can refer to the responsible regional partners and the supporting facilitators of the roadmap process. "People affected" refers to the marginalised and vulnerable groups and other relevant groups (those with the power to affect outcomes).*
2. *Core group of actors and proxies: In Regions4Climate, proxies can include advocacy groups, stakeholder institutions, or councillors serving the people affected and working as possible contact persons to reach different groups.*
3. *Core group of actors alone: In the Regions4Climate, this mainly refers to the responsible regional partners and the supporting facilitators of the roadmap process.*

Table 6. Actor involvement at each step of the roadmap process

Actor Involvement	**Roadmap Process**				
	Scope and Context Building	**Actor Identification and Involvement** *E.g., Identifying desired participants, defining best channels to reach them, first contact and recruitment, organizing practicalities for participating.*	**Defining Vision & Goal together** *E.g., Collecting and presenting necessary background information, problem re-definition, planning the vision and goal creation process, facilitation, developing the vision and goals.*	**Defining Actions Together** *E.g., defining the timing, relevant actors, resources needed, communications, refining and revising actions, monitoring and assessing outcomes.*	**Official Approval of the Roadmap**
Core group and people affected			*Problem re-definition, developing the vision and goals*	*Refining and revising actions, monitoring and assessing outcomes*	
Core group and proxies		*Identifying desired participants, defining best channels to reach them, first contact and recruitment*		*Communications*	
Core group only	*Scope and Context Building*	*Organizing practicalities for participating*	*Collecting and presenting necessary background information.* *Planning the vision and goal creation process, facilitation*	*Defining the timing, relevant actors, resources needed*	

After the involvement of each group at each stage has been planned, it is crucial to ensure that the design process is run in an inclusive, motivating and efficient manner. Building on the work of Jousilahti (2021, p. 10-11), five central principles can be outlined.

1. Allocate enough time and money to plan and deliver the participatory process. Appoint a clear, motivated person or persons to be in charge who can facilitate, i.e., guide people working together. Allocate enough working

time for them and ensure an adequate budget. Time and money should be spent on planning the process (e.g., setting objectives in collaboration with other organisers, marketing and other activities related to reaching out to participants, gathering the necessary background information for participants) and on organising the workshops and coordinating the work, with associated costs (e.g., possible travel costs for participants or catering) and working time needed (e.g. documenting, analysing, and communicating the results and evaluating the process).

2. Ensure real need, motivation, and engagement. There needs to be a real need for the actors' participation. Only invite people into a process if their input can and will be used. Be clear about what the participants can influence with their input, what they cannot (to manage expectations), and what they will get from the process - why should they want to participate? One of the most common pitfalls of participatory processes is that the use of the results is not properly planned. This can create "pseudo-participation", which can disappoint the participants.

Ensure everyone present knows why they have been invited, what their role is, and that the role motivates them. If not, modify the roles or consider inviting another person instead. If the process outputs are likely to change or create demands for someone's work, ensure these people are involved and willing to accept the output.

3. Share a clear goal, process, and how outputs will be used. Present a clear goal and process to the participants. Tell them clearly what will happen in-between and after engagements, how the results will be used, who is accountable for their use and how and when the participants can expect to hear back from the organisers of the process.

The results of the participatory process will not necessarily be implemented as such. What matters is that the organisers in charge provide a coherent justification for why the process outputs are or are not implemented.

4. Guarantee the accessibility of the process. Organisers often wish to have people from various backgrounds join the participatory process. This does not happen by itself. Start the invitation process by considering who you want to invite and why they might be interested. Participation tends to accumulate among the ones already active - the well-educated and people in good socioeconomic positions. To broaden the scope of participants to include people in more vulnerable positions, start by considering who is already in touch with the people you want to reach and if they could support you. This could be NGOs, residents' associations or social workers for example. Note that finding and engaging people who are less used to participating in this kind of processes can take time.

Make sure that information is available in different languages if needed. Use clear language and avoid the use of expert jargon in your communications. Ensure that (both live and possibly online) participants have equal access to information and that the facilities are accessible. Lower the threshold for participation by reimbursing travel experiences or providing childcare.

5. Document outputs and harness the learnings. Think ahead about how the findings and lessons learned will be captured. Careful documentation of the process is important so that the results and learnings can be used later. Set objectives at the outset against which the results will be measured. Have a plan for what data will be collected, how, and by whom. Collect feedback from the participants, other stakeholders and fellow organisers. Because you are probably doing something new, the process will likely go differently than initially planned. Think in advance

about how unforeseen outcomes can be noticed and collected. Be prepared to change the course of the process if necessary. Afterwards, evaluate the process internally or even with an external partner.

5.3. Defining the Vision and Goal Together

Once the context, scope, and relevant stakeholders have been defined (see Chapters 5.1 and 5.2), the roadmap process will proceed to the vision- and goal-defining phase.

Why visioning?

As famously put by the futurist Roy Amara (1981) in his "three laws of foresight", the future is not predetermined, the future cannot be predicted, and the future is influenced by our choices in the present. In everyday life, however, we tend to see the future as *one* future, take it as somewhat predetermined and a continuum from today and fail to think about the multitude of possible futures ahead of us. Although the future cannot be predicted, we can anticipate different possible futures due to various path dependencies, persisting habits and traditions, and slowly changing demographic structures. Challenging the "baseline assumptions" we have about the future and imagining radically different futures is important because how we think about the future affects our decisions and actions today, opening some future paths and closing others (Dufva et al., 2021).

Thinking beyond the current system and what we currently deem as projected or probable is about creating possibility. As Zittoun et al. (2021) state, *"What is often at stake is not so much what is ultimately possible or impossible, but rather the extent to which we are collectively choosing to dedicate resources (money, legislation, education) toward creating possibility. Possibility is not, in this sense, an inherent property of the world; rather, it is a social achievement."* The actual and the possible are not opposites but deeply interconnected since *"our sense of possibility and its exploration are grounded in what is already actualised and, most of all, transform our experience of the actual."* Hence, imagining possibilities is vital for creating desired futures today. Imagination sustains, nourishes, and transforms the possible.

The "Futures Cone" by Voros (2017a) depicts how our judgements about what is possible in the future relate to time. These judgements vary from the projected – the default, "business as usual baseline future", to what possibly could happen to the "preposterous" - the futures we judge to be impossible. In the immediate future, developments that differ greatly from the projected paths seem unlikely (see Figure 8). However, the horizon of possibilities broadens in the longer term; ultimately, anything is possible. This is especially true in the era we live in that has been described as "post-normal" - where shocks, controversies, and even chaos become more commonplace (Dufva, 2017 referring to Sardar, 2010; Sardar & Sweeney, 2016). Thus, we must also be willing to explore the so-called "impossible" futures through **visioning.**

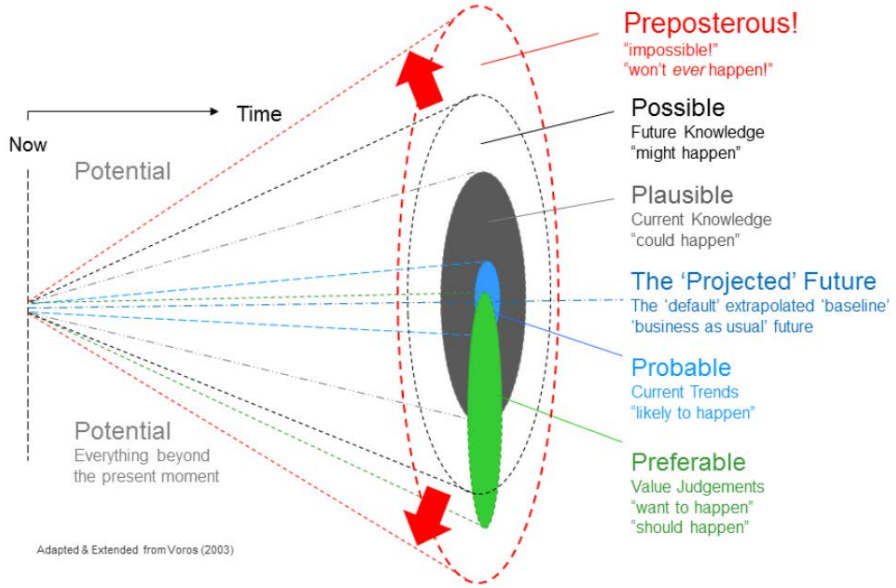

Figure 8. "The Futures Cone" (Voros, 2017b, published with permission of the author)

What is visioning – theoretical foundations

Foresight is a systemic approach to study possible futures and to influence them. Minkkinen et al. (2019) have created a typology of six different foresight frames (Figure 9) based on the level of pursued change (descriptive exploration vs. normative influencing) and the level of unpredictability (closed vs. open systems). The typology enables us to collectively make sense of what kind of foresight task we have in Regions4Climate – what we aim to do and not to do.

Foresight approaches falling under the *predictive frame* aim to formally calculate probabilities for future outcomes, e.g., through trend extrapolation or predictive modelling. The *scenaric and visionary frames* state that the future is profoundly uncertain, and thus, assessing probabilities is problematic and even dangerous. The *scenaric frame* fleshes out different possible futures without assigning probabilities to them. In the *visionary frame*, high-level normative goals are set to steer the future while admitting the high level of unpredictability in what kind of path could take us there. In the *critical and transformative frames*, foresight work is explicitly geared towards making sense of present assumptions and opportunities to expand the scope of possibilities for opening up new paths without defining the outcomes rather than representing futures (Minkkinen et al., 2019, p. 5-6).

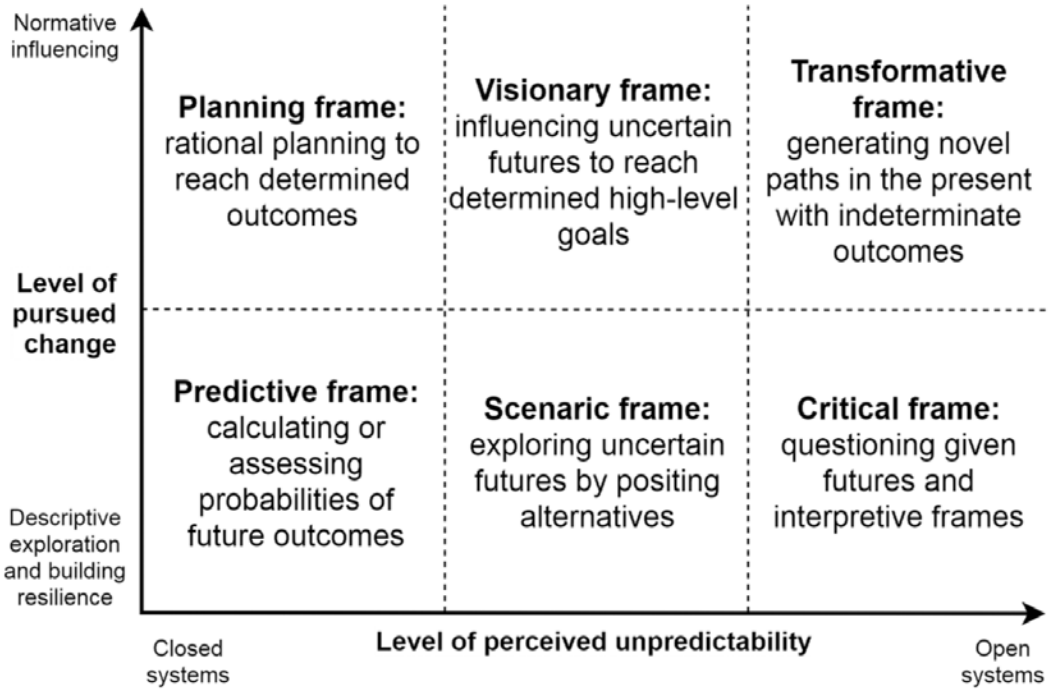

Figure 9. The alternative future frames of urban planning (Minkkinen et al., 2019)[2]

In the foresight approach applied in R4C, participatory backcasting can be located under the visionary frame (Minkkinen et al., 2019), i.e. we aim to influence how the future unfolds as, as described earlier, creating positive visions about the future is necessary for societal change and for avoiding getting stuck in the narrow thinking of what seems possible from the present perspective. At the same time, we admit the high level of unpredictability in how the vision(s) could be achieved and the fact that we do not have control of the future, especially given the complex nature of the transition to climate resilience.

How to vision?

The scope and context-building phase of the roadmap process defines the initial scope for the roadmap's activities (desired degree of change and level of intervention) and provides a baseline to which the later progress in the process can be compared (see Chapter 5.1). Once the scope for the roadmap has been defined and relevant actors, especially vulnerable groups, have been identified and engaged (see Chapter 5.2), the vision- and goal-setting phase through participatory backcasting starts. Ideally, this should be closely aligned with the previous

[2] Reprinted from Technological Forecasting & Social Change, 149, Minkkinen, M., Auffermann, B., Ahokas, I., Six foresight frames: Classifying policy foresight processes in foresight systems according to perceived unpredictability and pursued change, 1-13, Copyright (2019), with permission from Elsevier.

steps. In the actual situation, the core group's available resources and capacities might influence the breadth and depth of participation.

Backcasting is a specific type of scenario building, that can be described as manuscripts of the future that construct several different (probable, possible, or desirable) futures and paths leading to them (Figure 10). Backcasting is a normative method consisting of two parts: first, envisioning a preferred vision and, second, defining a logical path and developments necessary to get to the vision ("from then to now".) It can grow the future vision into a multi-faceted story about how the region is going to develop through the proposed actions. Backcasting differs from forecasting, where the future is “predicted” based on current trends (“from now to then”). It has a high potential to empower people to navigate complex challenges and ideate the actions that can lead to the envisioned future. Backcasting suits the study of complex, long-term problems that require creative and radical solutions, such as resilience to climate change (Heinonen & Lauttamäki, 2012, p. 306-307). When striving for truly transformational adaptation, backcasting is a good choice as it can ‘house’ both a large number and range of stakeholders and address the existing power imbalances (Bibri, 2018; Nikolakis, 2020; J. Robinson, 2003). As Neuvonen (2022) has summarized, backcasting offers particularly powerful results in settings where conventional paths and solutions are no longer feasible (Höjer & Mattsson, 2000) as it operates in the ‘context of discovery’, providing new and productive hypotheses on future action (Dreborg, 1996).

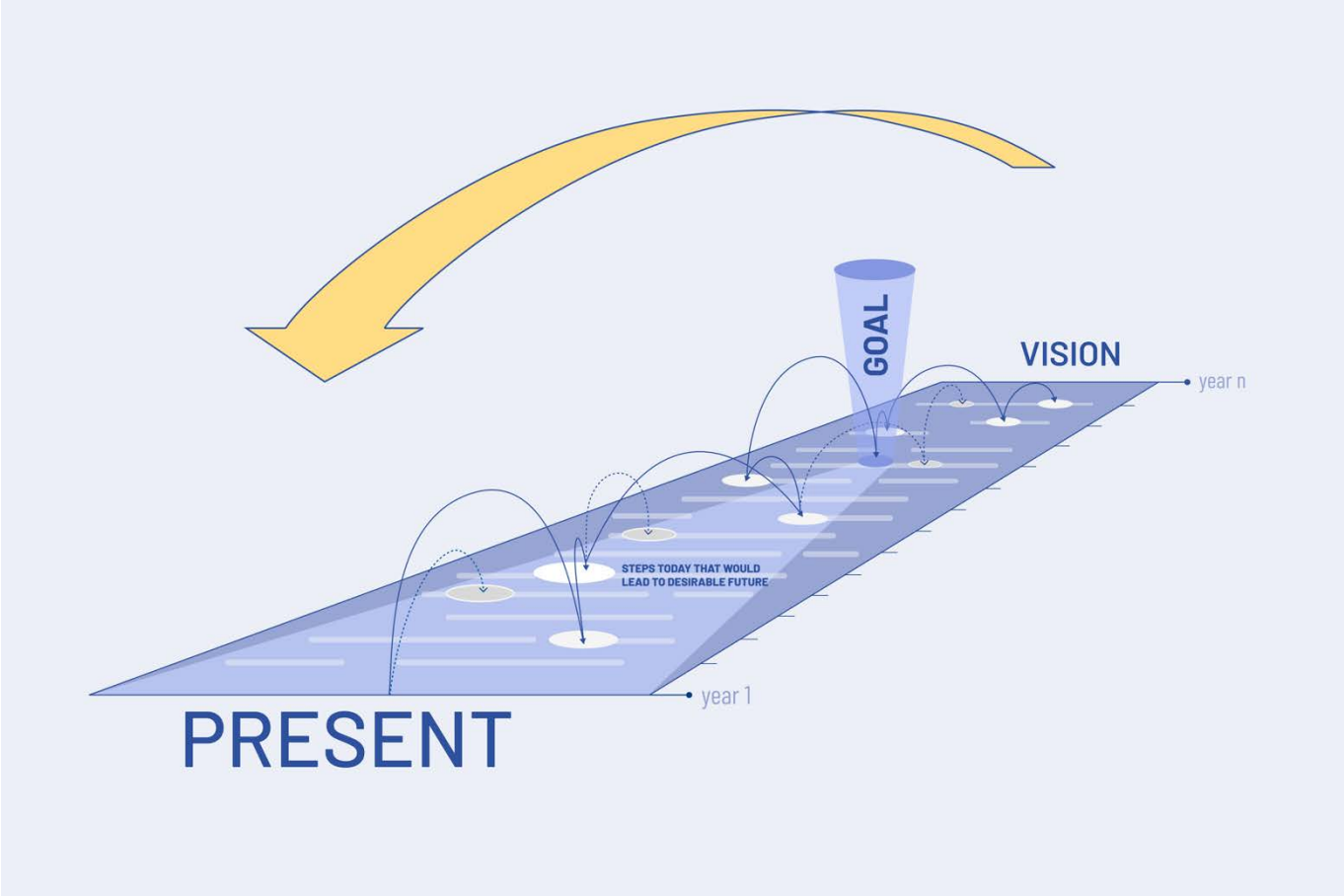

Figure 10. Backcasting divides the long-term vision into phases or milestones. The more manageable, short-term objectives would correspond with the goals of the roadmap, while trying to keep the broader vision “intact”, i.e., still maintaining logical chains of required actions in the long term.

In *participatory* backcasting, the process is run with a diverse group of actors – both those possibly affected by the measures that are being created in the backcasting process and the ones who have the power to steer the measures. A participatory approach ensures a higher quality of the outputs through a broader range of viewpoints and knowledge incorporated into the process and a stronger legitimacy of the results.

A vision in backcasting work can be defined as "a (wide) group of normative futures that meet the criteria of acceptableness" (Neuvonen, 2022, p. 59). In participatory backcasting the vision(s) - or futures states/images of the future - can be defined by these steps:

1. Define two critical uncertainties influencing how the just transition to climate resilience will unfold. This can be done collaboratively by listing major drivers for change, e.g., through the PESTE framework. Then, rank the drivers based on their importance and uncertainty and choose the two most relevant drivers as your critical uncertainties. The axes chosen should be of "high impact" and "high importance." As a result, a quadrant presenting four highly differentiated but desirable future states will emerge that can be later

developed into scenario narratives (Rhydderch, 2017). Creating these alternative future states ensures we think about the future broadly enough and are not stuck in the "business as usual" thinking and the inner realms of the "futures cone".

2. Construct a futures table to further build and enrich future states into scenario narratives. A futures table is a precisely defined framework about the future containing the most critical aspects of change in the topic. It is polarised on purpose to allow for the discussion of meaningful alternative development directions. The futures table shows the tensions and uncertainties (variables) of the topic we want to explore and their possible alternative development directions (values).

DEMOGRAPHY	SOCIOECONOMIC DISPARITIES	HEALTH	ECONOMY	CITIZEN PARTICIPATION	ENVIRONMENT
Ageing and declining population	Low disparities	Lifestyle diseases are the main cause for illbeing	Economy in decline due to ageing and declining population	Strong local democracy	Thriving local ecosystems due to strict regulation
Population growing due to immigration	High disparities	Mental health issues are the main cause for illbeing	Strong economy due to thriving regional innovation networks	Passive citizens	Private nature reserves as the main mainsf environmental protection
Growing population due tp high birth rates		Efficient health policies have increased people's wellbeing	Stong economy due to high government subsidies based on geoeconomic and geopolitical intrests	Active participation mobalized by a populist leader	75% decline in biodiversity from the year 2000 level
Growing population due to internal migration		Climate change related health issues on the rise		High distrust in a democracy and governance	Recovering ecosystems due to changes in consumption

Figure 11. Example of a futures table

3. A couple of different values will be set in advance for each scenario to ensure the future states differentiate enough from each other. After that, different values will be chosen for each variable based on a chosen principle, such as good-average-bad, different extremes, gut feeling or desirability. Choose which values fit the principle and colour the selected cells.

DEMOGRAPHY	SOCIOECONOMIC DISPARITIES	HEALTH	ECONOMY	CITIZEN PARTICIPATION	ENVIRONMENT
Ageing and declining population	Low disparities	Lifestyle diseases are the main cause for illbeing	Economy in decline due to ageing and declining population	Strong local democracy	Thriving local ecosystems due to strict regulation
Population growing due to immigration	High disparities	Mental health issues are the main cause for illbeing	Strong economy due to thriving regional innovation networks	Passive citizens	Private nature reserves as the main mainsf environmental protection
Growing population due tp high birth rates		Efficient health policies have increased people's wellbeing	Stong economy due to high government subsidies based on geoeconomic and geopolitical intrests	Active participation mobalized by a populist leader	75% decline in biodiversity from the year 2000 level
Growing population due to internal migration		Climate change related health issues on the rise		High distrust in a democracy and governance	Recovering ecosystems due to changes in consumption

Figure 12. Example of a Futures table with certain variable values selected

4. After the cells have been selected, they are combined into different futures states, "snapshots" of the future that describe the end states of scenarios. In practice, the snapshot can take the form of a headline, that summarizes then core idea of that scenario, and a brief, two to three paragraphs' description of the scenario world.
5. After the alternative future states have been explored, a vision for the climate resilient region in e.g., 2050 is formed (a target year far enough in the future enables broad enough thinking that is not limited by the realities of today.) A vision is a clear and aspirational description of an ideal future state or outcome that an individual, organization, or community aims to achieve. Laine (2017) has described a good vision as follows (translations by the author):

- *Attracts interest and is not forgotten, i.e., it comes up at least occasionally*
- *Describes a state of affairs that is different from the status quo, i.e., not based on keeping something as it is or averting a threat*
- *Is authentic and natural to its community - a good test is whether any member of the community can state the vision in a natural way*
- *Avoids one-way, black and white - can be described in many different ways, engages in dialogue*
- *The target audience has been considered in advance, the language and the way it is done is appropriate to the purpose*
- *Does not appeal to everyone*
- *Inspires further reflection and interpretation*

6. Once the vision has been described, shorter-term goals will be defined. This phase builds on the context-building and scoping exercise (see Chapter 5.1), which provides relevant information and knowledge on political, sociocultural, economic, and environmental aspects that affect the pursuit of just transition to climate resilience in each region. Based on these materials —a long list of tentatively most relevant areas— participants choose three to five important areas where actions are needed to arrive at the vision defined earlier. These so-called "action portfolios" can address the following topics, to withstand climate-related stresses:

- *The resilience of critical infrastructure, such as transportation networks, energy systems, water supply, and wastewater treatment facilities*
- *Sustainable water resource management, including water conservation, groundwater recharge, and stormwater management*
- *Protection and restoration of natural ecosystems, such as wetlands, forests, and coastal habitats, that provide valuable services like flood control, water purification, and biodiversity conservation*
- *Emergency response that accounts for climate-related events such as hurricanes, floods, wildfires, and extreme heat events*
- *Land-use regulations to discourage development in high-risk areas*
- *Public awareness about climate risks, adaptation measures, and emergency preparedness*
- *Partnerships and funding to support adaptation efforts*

5.4. Defining Actions Together

The pursuit of a just transition towards climate resilience is a collaborative effort. As described in the previous chapter, that effort should be guided by a vision, but it also needs to be planned. A regional roadmap may include collective and individual actions utilising various tools and methods to ensure impactful outcomes. This chapter explores the process of **defining and refining actions together** and introduces tools and methods (or approaches) to guide the development. It also shows how the actors/stakeholders can be given roles in resourcing, implementing and measuring results. It is preferable that at least some of them have been on board from an early stage (e.g., a core group of actors in the Scope and Context Building phase) and shaped the understanding of the roots of the problems that are then addressed together.

Defining the actions together may require a combination of collective sense-making, creative brainstorming, and rigorous evaluation through which stakeholders can relate to the key trajectories of change and name the required actions for just transition/transformation. It considers the questions of efficiency and credibility of the planned actions in relation to the vision (defined in the earlier stage of the roadmapping), as well as the legitimacy of the whole endeavour. It also shows which topics should be considered if the aim is to focus solely on the justice issues of transition.

Once a region has already developed the long-term vision of the desired future and the shorter-term goal (Chapter 5.3) with a large group of actors, it is well-positioned to develop a good set of relevant actions. Assuming the

process paid particular attention to the vulnerable groups and marginalised people, maybe through their involvement or other insights into their interests. In that case, the actions are already likely to pay considerable attention to justice issues. However, when shaping the action portfolio and coming up with the actions, it would still be worth reflecting on how high the bar has been set in the matters of stakeholder interactions and levels of recognition. The four-field in Figure 13 (Malloy, 2021) illustrates that transformational and just adaptation would require that:

1) the power and agency in decision-making processes has been highly/clearly recognised, and
2) the degree of interaction among stakeholders is high as well.

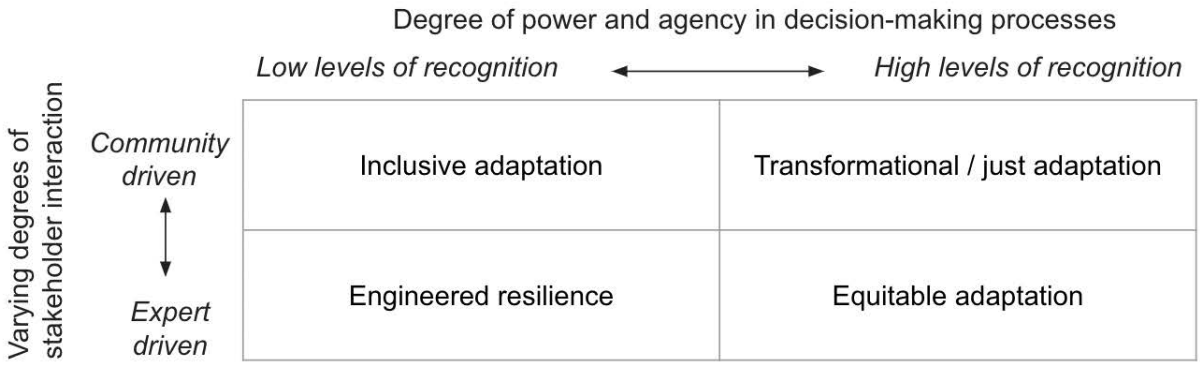

Figure 13. Dimensions of justice in climate adaptation policy implementation, adapted from Malloy (2021)

When working towards the shorter-term goal of the roadmap, the transformational adaptation is likely to appear like a major stretch. However, from the beginning, it would be essential to get the process on the correct track in terms of transparency and justice.

How interventions potentially affect social justice and transformation can be illustrated with some examples:

(1) *Digital twins for community engagement (see Figure 6) can potentially transform how planning for climate resilience is performed. They allow for illustrating climate change impacts and for testing different solutions on how to tackle these impacts. They can also serve as a communication platform with different stakeholder groups. This means digital twins are interventions at the micro level that potentially have procedural and relational consequences at the meso level (see Figure 3).*
At the same time, digital twins have to be carefully planned with respect to social justice. The digital twin should be able to recognise and represent the needs of those most vulnerable to climate change. This implies, on the one hand, that knowledge about vulnerable and marginalised groups is integrated (recognitional justice) and, on the other hand, that the digital twin has to be accessible for these groups (distributional justice).

(2) *The restoration of marshlands currently used as agricultural land as a means of flood protection has transformative power at the regional level because it shifts flood protection from technical solutions towards nature-based solutions. At the same time, it also has transformative power for the regional economy when the land is not available anymore for agriculture and income possibilities for farmers have to be rethought. The question of how to compensate for the potential loss of income is closely linked to questions of distributional and restorative justice (see Table 3).*

(3) *Dynamic waterfront management means that waterfront areas are used so that temporary flooding does not cause substantial damage to assets and that infrastructure and people are protected. This has to be balanced against the harm and economic losses caused when the waterfront is temporarily unavailable. On the one hand, dynamic waterfront management can have a transformational impact on some socioeconomic sectors when the use and activities in these areas have to be reassessed. This means the action can affect at least people's everyday practices at the meso level, and its influence can even affect shared vision and goals if all actors agree to re-evaluate the priorities of waterfront usage (see Figure 3). On the other hand, this action requires careful consideration of costs and burdens, rights and responsibilities (distributional justice) and the potential compensation of incurred costs and burdens (restorative justice). Also, in planning this action, it might be advisable to include a large group of actors and stakeholders that is not limited to those economically affected (recognitional and procedural justice).*

In broad terms, the definition of actions is about bridging the gap between wishes for the future and the current state of affairs in the region. A good action portfolio does not favour superficial actions but dares to address issues that require profound changes, i.e., are transformational. It is also noteworthy that many problematic issues that could have easy, often technical, fixes in the short term are reinforced by structures (rules, policies, hierarchies), which may jeopardise the striving for resilience in the longer term. Changing the mental models (beliefs, values) that fuel the current unsustainable patterns might be even more difficult to address through these actions. However, it should not lead to them becoming entirely bypassed.

The level of ambition would have to correspond with the methods chosen for defining actions. No single method can guarantee that the set of actions is transformative. On the other hand, certain methods might already skew the process away from the transformative path. It is good to be aware of this when choosing the methods. The more they give room for negotiation amongst stakeholders, and the more they address the existing power relations and injustices, the better.

In the context of Regions4Climate, the actions of the roadmap can build on the regions' Innovation Actions tested and implemented in WP5 and should be well embedded in other regional adaptation and resilience building activities.

5.4.1. Actions, Timing, Actors, Resources

A good roadmap not only proposes actions but also makes their timing, actors, and resources explicit for ensuring effective coordination, resource optimisation, risk management, accountability, communication, and overall success in achieving the desired objectives.

For defining actions, backcasting (introduced in Chapter 5.3) is a robust and a rather popular technique/method for imagining pathways from a distant future to the present (Neuvonen, 2022), as well as to determine actions within multi-stakeholder initiatives (Bibri, 2018; Nikolakis, 2020; J. Robinson et al., 2011). As it works with desired futures, it is a value-laden approach (J. Robinson, 2003). It is common to use a backcasting process to define a set of scenarios instead of one future vision only and to then come up with the pathways and actions that link the different futures with the present.

In the Regions4Climate context, the normative goals – climate resilience and just transition – are rather evident. The required actions can thus be backcasted starting from the single vision, the making of which was described in Chapter 5.3.

Depending on the regional context and the vision and goal, the domains/themes of the backcasting exercise could include some of the following:

Water management; Coastal communities; (Critical) Infrastructure; Food systems; Preservation and restoration of ecosystems; Climate-related health risks; Disaster preparedness; Awareness; Regional economic sectors; and Skills development.

All these can be worked through as separate domains. Each domain can be put on the timeline (with the future vision typically at least 20 years ahead) and then worked through to figure out the necessary steps to bridge the future vision with the present state of affairs. If the future vision does not explicitly touch upon a specific domain, its future could still be "extrapolated" based on the vision.

The backcasting exercise would aim to ensure that adaptation actions prioritise vulnerable and marginalised communities and hence strengthen recognitional justice. During the work, if proceeding domain per domain, the stakeholders would always have to be ready to flag issues that could jeopardise the justice aims. As a collaborative exercise, this domain-based work would already serve as a preliminary feasibility analysis. Since not all actions can be tackled simultaneously, it is essential to prioritise actions based on their potential impact, feasibility, and urgency, or even from the perspective of justice and transformational power.

The process should explicate at least the intended results, necessary resources, leading agency, other key partners and timescale (see Urbact). There are several tools for preparing a systematic list of actions, with one template below.

Goal(s) of the Roadmap:					
Action	Intended Result	Resources	Leading Actor	Key Partners	Timescale

Figure 14. Action table as a tool to systematically list all actions and related information for a roadmap

Once the actions – as well as their timing, contributing actors and foreseen resources have been sketched out, the following supporting questions (summarized in Table 3) could be discussed amongst the participants:

- *Do the identified actions consider the needs of those vulnerable to the impacts of climate change and transition and marginalised? Could it be that some voices have been left unheard due to the marginalised position of these people? Could these missing voices still be listened to, and the respective concerns still be addressed?*
- *Has the process of defining actions been transparent and inclusive (avoiding jargon, accessible, no hidden agenda)?*
- *Are the burdens, costs and benefits of the actions distributed justly? Do the actions potentially perpetuate old or create new vulnerabilities or inequalities?*
- *Do the actions contribute to the reconciliation of pre-existing unjust distribution of burdens? Is there a compensation if an action causes unequal distribution of burdens and costs?*
- *Do the actions promote climate resilience at a systemic level? Do they potentially create new risks elsewhere (temporal and spatial)?*

5.4.2. How to Monitor Outcomes?

Clear success criteria for the roadmap and its individual actions are essential for credibility. These criteria are necessary to prove the roadmap's effectiveness to funders, policymakers, and the community. Holding responsible parties accountable for the plan's implementation and outcomes could also be challenging. Indicators can serve as measurable benchmarks, providing insights into whether an action or roadmap is achieving its intended goals and helping to see which parts of the execution need improvement. They bring consistency to the evaluation by providing a standardised and systematic approach to measuring progress, making comparing results over time and across different initiatives easier. However, a qualitative description of what is considered a successful implementation can also be valuable for monitoring the implementation of actions. The success should be assessed with respect to climate resilience, the justice dimensions outlined above, and its potential contribution to transformation.

The Climate Resilience Maturity Model developed and applied in Regions4Climate has proposed indicators that may be suitable to provide a baseline for the roadmap activities and allow for the monitoring of outcomes. The regional actors can choose the most suitable ones for their context and estimate if the selected resilience maturity indicators have improved after implementing a roadmap action. Suitable indicators can also evaluate how far an activity reduces the vulnerability and/or exposure to climate risks and the transition to climate resilience for those groups identified in Chapter 5.2. This can be aligned with the vulnerability and risk assessment in WP3 of Regions4Climate.

The more closely the stakeholders have been co-defining what success looks like (e.g., through the vision and goal creation), the more interest they are likely to have in following up the process and, more importantly, in doing their best for its success.

What can cause some confusion are the different time scales of the vision and the roadmap of actions, as well as those of the roadmap and the Regions4Climate project. Assessing progress toward the long-term vision may require different metrics and evaluation criteria than those used for short-term actions. There might also be little evidence of progress towards the more transformative vision during the project period, as the impact of the interventions can become conceivable with a considerable delay.

5.4.3. Refining and Revising Actions

Completing the first version of a roadmap, the actions of which have been prepared through a collaborative process, paying particular attention to the justice issues, is already a great achievement as such. For the most enthusiastic actors, it would be tempting to proceed to the execution phase directly. However, some refining could be useful. For instance, inviting external experts to revisit the freshly accomplished roadmap/action plan offers a valuable opportunity. The experts can offer a fresh perspective and complementary expertise and identify areas where improvements or refinements might still be needed. The actions would also benefit from grouping them into meaningful action portfolios to benefit from synergies that joining forces across sectors and disciplines can bring. Portfolios support a holistic approach that recognises the interconnectedness of various initiatives.

The action plan refinement can also proceed through estimating costs for each proposed action and each portfolio of actions. A somewhat more comprehensive approach that can be used is the cost-benefit analysis. It provides a framework to compare benefits against costs transparently to support the choice and prioritisation of actions. Its strength is quantifying a range of factors to prioritise initiatives with maximum societal, economic, and environmental gains and efficiency in terms of resources. However, cost-benefit analysis not only requires a considerable amount of work and can be limited by challenges in accurately quantifying intangible factors, such as social and environmental impacts. It may also neglect marginalised voices and fail to consider long-term consequences. Additionally, reliance on monetary metrics might oversimplify complex issues and undervalue non-economic aspects, leading to skewed decisions.

Other potential methodologies include stakeholder workshops combined with expert judgements. An interesting benchmark here comes from the municipality of Kalundborg in Denmark, where scenario workshops, combined with a citizen summit, were organised to discuss adaptation to changes in precipitation, flood patterns, storm surges, and rising sea level. Stakeholders first explored climate scenarios and developed solutions using a scenario workshop method. Experts also assessed these solutions, and in a second scenario workshop, the stakeholders refined the solutions, including the newly gained knowledge. The summit engaged 350 local citizens in discussing climate adaptation strategies. The environmental and socioeconomic consequences of the options were presented, and citizens voted on them, giving democratic legitimacy to the actions proposed by the stakeholders. Two-thirds voted to phase out the current land use in the most threatened non-urban areas and turn the farmland and summer cottage areas into wetlands instead of trying to protect the current land uses by building dikes. The open deliberation on the available options helped the citizens to understand what is at stake and supported the politicians (Bedsted & Gram, 2013).

Some planned actions might have to be thought through in considerable detail. The Urbact program has developed a simple tool: Refining an Action Table https://urbact.eu/toolbox-home/planning-actions/refining-action. It helps to develop concrete actions by “planning them in detail, thinking about activities, timescale, outputs resources and obstacles”.

The roadmap preparation process does not need to be a one-time effort but a dynamic and responsive framework that evolves with the incorporation of new information, emerging challenges, and lessons learned, enabling the plan to stay aligned with evolving goals and circumstances. This is also a matter of communication and transparency, which can be supported by accessible documentation, paving the way to expressing commitments towards the roadmap (see next Chapter).

5.5. Official Approval of the Roadmap

An official approval of the roadmaps can be highly beneficial. Depending on the scope of the roadmap and the involved actors, the commitment can be expressed by a (regional) public authority or other relevant actors that can publicly state and confirm their commitment. In the Regions4Climate context, where the roadmap is created through a voluntary process – promoted by the European Union / Horizon programme – the approval is likely to be non-binding.

Official approval of a document, even if non-binding, can send a strong symbolic message about the commitment and intent of the involved parties. It shows a collective understanding and acknowledgement of the importance of climate resilience. The approval can also help to share accountabilities and responsibilities among stakeholders. While the stakeholders are not legally bound to adhere to its provisions, they are more likely to be held accountable by the public, media, and other stakeholders if they deviate from the proposed actions or fail to implement some foreseen measures.

The official approval can establish guiding principles and related practices that stakeholders are encouraged to follow voluntarily. These principles can provide a framework for decision-making and action, promoting consistency and alignment across different entities. Furthermore, the approval process can foster regional collaboration by bringing together different entities to address climate resilience collectively. It can also lay the groundwork for more comprehensive and binding agreements as stakeholders become more comfortable with the commitments and actions proposed in the document.

The commitments of various organisations to the roadmap can also be gathered together, e.g., by designing a regional charter or by collecting Letters of Commitment to the roadmap. This can also be combined by becoming a signatory of the EU Mission on Adaptation to Climate Change. By signing up for the Charter and the tenets of the EU Mission on Adaptation to Climate Change, regions can become part of a broader community of practice that offers opportunities to learn from other regions and communities in Europe.

6. Conclusions

The Just Transition Framework laid out in this document has two objectives. First, the framework discusses the theoretical underpinnings of just transition to climate resilience. Second, it suggests a procedure for preparing regional just transition roadmaps.

Under the first objective, we describe justice along the four dimensions: recognition, procedure, distribution, and restoration. We elaborate on the differences and nuances between transition and transformation, and we identify a set of enablers and barriers associated with different system levels ranging from individual practices and policies to mindsets and paradigms that build the backbone of our societies.

It is important to highlight the specific settings for just transition to climate resilience and pinpoint the differences to, e.g., just transition to a carbon-neutral society. Whereas a carbon-neutral society requires action to stabilise and ultimately reduce the concentration of greenhouse gases in the atmosphere, resilience to climate change means reacting to and anticipating a range of different climate change impacts varying over time, space, systems, and social groups. Therefore, the challenges for social justice and transformation in building climate resilience differ from those associated with climate change mitigation and the carbon-neutrality goal.

Based on this conceptualisation, we provide a preliminary screening of the challenges and opportunities for the 12 regions in Regions4Climate concerning the four justice dimensions and transformative adaptation. The screening indicates how the different dimensions of justice are integrated into climate adaptation plans at present, how just transition is envisioned in the innovation actions within Regions4Climate, and further if any components of just transition to climate resilience appear to be weak or less developed in the particular region, and hence, how these topics could be addressed in a roadmap process as a stepping stone for the longer term adaptation to climate change at the regional level.

Under the second objective, we prepare the ground for the upcoming task of preparing regional just transition roadmaps for each of the 12 regions. We suggest a process structured into five logical steps (Scope and Context Building, Actor Identification and Involvement, Defining Vision and Goal Together, Defining Actions Together, and Official Approval of the Roadmap). In each of these steps, we pay special attention to social justice and the transformative potential of the roadmaps. Both the process of preparing a just transition roadmap and the content of the roadmaps have to be in line with the four justice dimensions. At the same time, the transformative process towards climate resilience can be strengthened by how the roadmaps are prepared and by implementing the actions laid out in the roadmaps.

The Just Transition Framework and the regional just transition roadmaps that are going to be prepared in line with the framework are closely connected to several other activities in Regions4Climate. The social vulnerability analysis (D2.1) provides input for this framework and the roadmaps. The preparation of the roadmaps is also going to benefit from the information available via the Climate Resilience Maturity Assessment and the Governance Framework in WP4 and potentially also from the system dynamic modelling (WP2) and the Climate Resilience

Diagnostics (WP3) work. The just transition roadmaps have further touch points with the ongoing innovation actions in WP5 and the conceptual development for S4+ Strategies (WP4).

So far, the Just Transition Framework has been a desktop study, and it has to prove its potential when tested in the 12 regions in Regions4Climate. The described procedure for preparing the roadmaps is idealised and untested. This means that when implementing the roadmap process, one has to be very alert to the specific regional context and open to learning and adjusting the process without losing sight of the just transition to climate resilience.

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7. Glossary

Roadmaps are an instrument to lay out and orchestrate actions that serve a specific goal or vision among a broad range of stakeholders. They include a clear time horizon by when the goal of the roadmap should be achieved and a timeline on which the actions are placed. The scope of roadmaps can focus on specific innovations or well-defined challenges, sectors, subsystems or far-reaching societal changes and transformations. Roadmaps often include a graphical illustration of the actions, timeline, and goal (Antuña-Rozado et al., 2016; Miedzinski, Mazzucato, et al., 2019; Miedzinski, McDowall, et al., 2019).

Transformation refers to a fundamental change in the attributes of natural and human systems (IPCC, 2023). This can include fundamental and deep changes in e.g., individual and collective values and worldviews, new and more balanced power relations, and new interfaces between social groups, ecosystems and technology (Heikkinen et al., 2019; IPCC, 2023).

Transition is the process of changing from one state or condition to another in a given period of time. Transition can occur in individuals, firms, cities, regions and nations (IPCC, 2023). The process works across multiple levels, involves multiple actors and is non-linear e.g., in the pace of change over time.

Adaptation refers to process of adjustment to actual or expected climate change and its effects with the aim to moderate harm or to exploit potential benefits (IPCC, 2023).

Climate resilience is broader than adaptation and refers also then enhancement “of the capacity of society and the natural systems we rely on to persist, adapt and transform, in anticipation of and response to disruption and crises”. (Lager et al., 2023, p. 4).

Climate justice links development and human rights to achieve a human-centred approach to addressing climate change, safeguarding the rights of the most vulnerable people and sharing the burdens and benefits of climate change and its impacts equitably and fairly (MRFCJ, 2022).

Vulnerability refers to specific characteristics of people or assets that make them susceptible to adverse outcomes. These outcomes may relate to climate change impacts as well as to the outcomes of transition to resilience and adaptation efforts (IPCC, 2023).

Marginalized groups are those excluded from mainstream social, economic, educational, and/or cultural life. Examples of marginalized populations include, but are not limited to, groups excluded due to race, gender identity, sexual orientation, age, physical ability, language, and/or immigration status. Marginalization occurs due to unequal power relationships between social groups in society (Baah et al., 2019)

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