

# Designing policies for transformative recovery: The Strategy Shock Implementation Reaction (SSIR) framework

Sebastian Seebauer<sup>1\*</sup>, Eva Posch<sup>2\*</sup>, Thomas Thaler<sup>3\*</sup>, Claudia Winkler<sup>1</sup>, Hermine Mitter<sup>3</sup>

<sup>1</sup> JOANNEUM RESEARCH Forschungsgesellschaft mbh, Graz, Austria  
LIFE Institute for Climate, Energy, and Society  
ORCID: 0000-0003-4592-9529 (Seebauer)  
ORCID: 0000-0003-3829-1459 (Winkler)

<sup>2</sup> University of Innsbruck, Innsbruck, Austria  
Department of Public Finance  
ORCID: 0000-0002-7099-2960

<sup>3</sup> University of Natural Resources and Life Sciences, Vienna, Austria  
Institute of Mountain Risk Engineering (Thaler)  
Institute for Sustainable Economic Development (Mitter)  
ORCID: 0000-0003-3869-3722 (Thaler)  
ORCID: 0000-0003-0799-9489 (Mitter)

\* SS, EP, and TT share first authorship.

## Abstract

Future shocks from climate change impacts will likely overstretch current coping capacities. Integrated policy strategies could foster resilient reactions by using the rebuilding phase for transformative recovery instead of bouncing back to the pre-shock status. To advance the conceptual discussion towards integrated strategies, we present the Strategy Shock Implementation Reaction (SSIR) framework that links research on strategy formation in environmental governance, the role of shocks in opening policy windows, and motivations for individual preparedness. We demonstrate the SSIR framework on two examples of integrated climate change adaptation and mitigation policy ('adaptation'): planned relocation and building renovation. The SSIR framework illustrates how a shock converts an intended into an implemented strategy and how this conversion influences how a strategy impacts individual reactions. We re-conceptualize shocks from mere policy windows to policy filters. We discuss how the SSIR framework may be used to analyze how policy strategies evolve and function over time.

*Keywords:* adaptation; mitigation; recovery; transformation; critical event; strategy development

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# 1 Introduction

Various extreme events in recent years, such as the floods across Western Europe in 2021, the current droughts in Africa, heat waves in the United States in 2020, or wildfires in Greece in 2020, had severe impacts on our social, economic, and ecological systems. Typical government reactions to these events are to provide insurance, charity, and aid payments (Thaler & Fuchs 2020). Usually, these financial compensations strive for fast bounce-back without changing the current physical and social vulnerability of individuals or businesses, and without using the momentum for a broader transformation towards a climate-neutral and resilient society (Slavikova et al. 2021). A rushed return to normality may cater only to the short-term demands of those affected, as the flood disaster-aid payments in Germany did (Osberghaus & Fugger 2022). Because of climate change, extreme weather events will continue to happen, will most likely increase in the future (Dottori et al. 2018; IPCC 2022; Raymond et al. 2020), and will eventually overstretch current system capacities. This raises the question of how to develop policy strategies that foster long-term resilient reactions and transformative recovery in the aftermath of shocks such as extreme weather events. We define policy strategies as patterns in a stream of decisions, either intended or emerging, that plan for the long term and address a specific policy problem (Mintzberg 1987).

Designing policy strategies from an adaptigation perspective, that is, integrating climate change adaptation and mitigation (Langlais 2009; Göpfert et al. 2019), could lead to more sophisticated responses to shocks. Generally, climate change adaptation and mitigation follow different strategies, institutional frameworks, and implementation actions. This does not only cause different aims and competing approaches to reaching these aims, but may also create conflicts or discrepancies (Landauer et al. 2019; Kondo et al. 2021) and may result in clumsy solutions (Hartmann 2011). Actions in climate change adaptation may, however, encourage climate change mitigation activities and vice versa (Langlais 2009). Thus, since limited resources are available for coping with climate-related shocks and for combating climate change, adaptigation strives to develop policy strategies that integrate complementary approaches rather than only pushing a single solution to the most pressing problem.

Shocks can provide opportunities for advancing the adaptigation agenda and for building back better in order to withstand future climate change impacts and reduce carbon emissions. Shocks are often turning points that enable far-reaching changes in policy strategies (Thaler et al. 2020). By means of policy strategies, governments set the regulatory boundaries and the incentives within which households and businesses act. Thus, if policy strategies are designed and implemented with a dedicated adaptigation perspective, it is more likely that recovery after a shock will result in more climate-resilient and less carbon-intensive outcomes.

A conceptual framework bridging the design of policy strategies to their implementation after a shock and the following individual reactions is still missing, however. To advance this conceptual discussion, we present the Strategy Shock Implementation Reaction (SSIR) framework that links three strands of research, separate until now: (1) environmental governance theories on how policy strategies are developed and implemented; (2) empirical studies on the role of shocks in opening policy windows; and (3) psychological action theories on how households or businesses prepare for future shocks. The SSIR framework will frame and stimulate research on the processes of how specific policy strategies lead to specific individual reactions after a shock. In the following section 2, we present the phases and elements of the SSIR framework. Section 3 then applies the SSIR framework to two examples in the housing sector, planned relocation and building renovation, to illustrate potentials for adaptigation. Section 4 discusses research directions but also limitations arising from the SSIR framework. For more accessible reading, the respective framework elements are highlighted in bold font when first mentioned in the text.

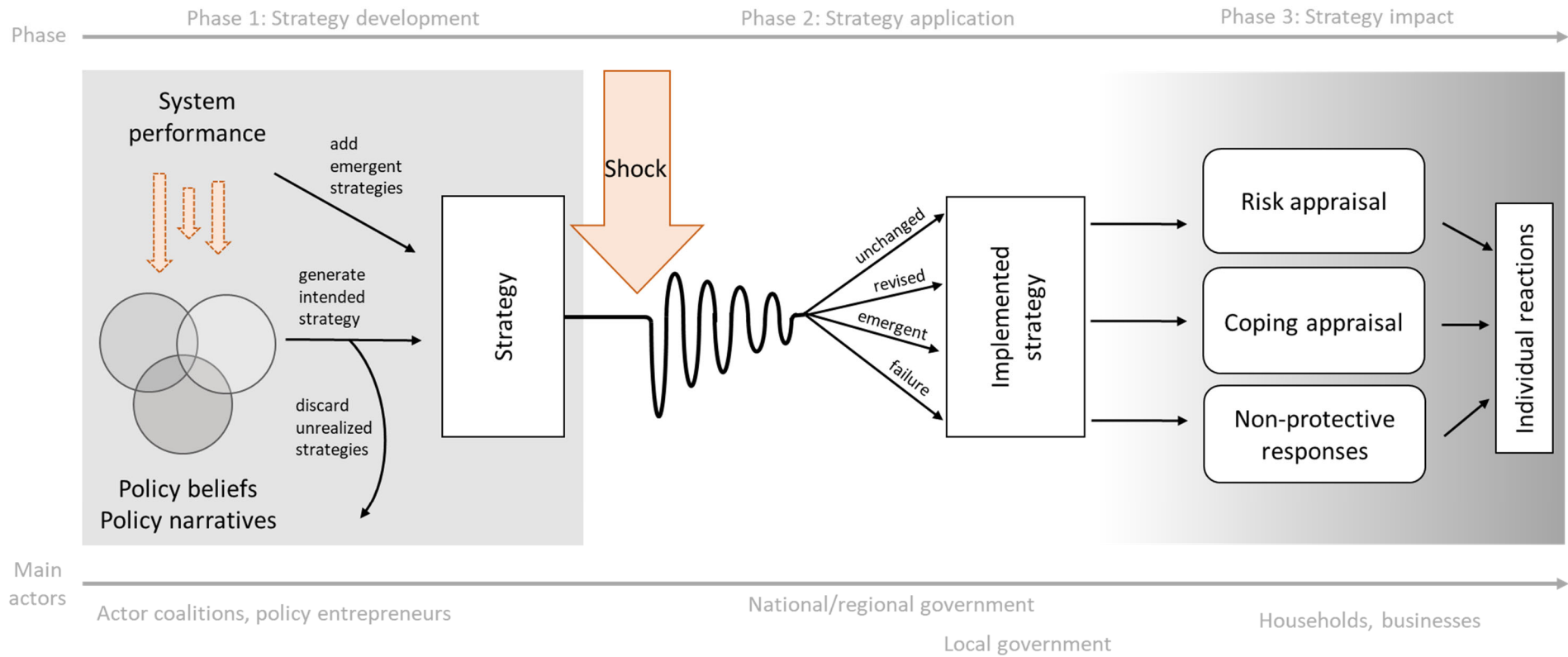
## 2 The Strategy Shock Implementation Reaction (SSIR) framework

The Strategy Shock Implementation Reaction (SSIR) framework depicts the nexus between policy strategy, shock, and individual reactions (Figure 1). The conceptual framework proposes an interplay of government- and individual-level factors to understand how the prevalent policy strategy is filtered during and after a shock, directing households or businesses to a specific set of individual reactions.

The framework is divided into three phases: In the **first phase of strategy development**, a policy problem appears when actual conditions no longer comply with stated goals and objectives, and a dedicated strategy is developed to respond to the problem. The **second phase of strategy application** begins when a shock occurs, necessitating the implementation of the strategy. In the policy window following the shock, strategies are either implemented as intended, are revised, or emerge. The phase ends when all relevant policy solutions of the strategy have been implemented. The **third phase of strategy impact** begins when emergency measures are completed, and households and businesses start considering long-term recovery and prevention of future shocks. It ends when these individual actors have taken specific reactions regarding their well-being, properties, and assets.

The three phases correspond to the underlying assumptions that (1) beliefs and narratives influence strategy development (Kahan et al. 2007; Davy 2008; Hartmann 2010); (2) shocks influence existing strategies (Grossman 2015); and (3) implemented strategies influence individual behavior (Babcicky & Seebauer 2019). Figure 1 shows the process from strategy to shock to reactions posited in the SSIR framework. For an overview of definitions, the framework elements are summarized in Table 1. The next sections deduce the elements' theoretical background: First, we reflect on how policy strategies are informed by narratives and beliefs stemming from actor coalitions and policy entrepreneurs (section 2.1); then, we describe how shocks initiate the implementation, revision, or emergence of strategies (section 2.2.); and finally, we discuss the drivers and forms of individual reactions (section 2.3).

**Figure 1: The Strategy Shock Implementation Reaction (SSIR) framework**



**Table 1: Definition of all SSIR framework elements**

Element	Definition	References
Policy beliefs	A set of values that follows a systematic pattern. Policy-relevant beliefs determine the preferences of a group regarding a specific problem; a group takes action based on the shared set of beliefs.	Sabatier 2007; Zahariadis 2007; Biesbroek 2021; Kammermann & Angst 2021; Zhou et al. 2021
Policy narratives	Competing views that are produced, evolved, or shared in a discourse between the actors involved. Narratives include specific views about the nature and causes of a policy problem and the potential policy solutions, but also connect these specific views with the general ideology, identity, and policy beliefs of the involved actors.	McBeth et al. 2005; Shanahan et al. 2011; Shanahan et al. 2013; Jones et al. 2014; Crow & Jones 2018
Strategy	<p>A pattern in a stream of decisions either intended or emergent that plans for the long-term and addresses a specific policy problem.</p> <p>Intended strategy: A pattern of policy solutions developed purposefully from deliberations on how a policy problem will persist or worsen in the future. It explicitly addresses the stated goals/objectives.</p> <p>Emergent strategy: A pattern of policy solutions that emerges in the absence of intentions but is consistently replicated or transferred. It may only implicitly address the stated goals/objectives.</p> <p>Unrealized strategy: Policy solutions that were debated within policy narratives, but did not become part of the strategy.</p> <p>Implemented strategy: A series of activities undertaken by government to achieve the stated goals/objectives, realizing the policy solutions prescribed by the strategy. The activities directly affect households and businesses.</p> <p>Revised strategy: A strategy that is substantially reoriented or expanded subsequent to a shock or to a policy development before being implemented.</p> <p>Unchanged strategy: A strategy implemented as originally prescribed, with only marginal amendments or omission of selected policy solutions.</p> <p>Failure: A strategy that substantially underperforms when applied to a shock.</p>	Mintzberg & Waters 1985; Mintzberg 1987; Matheson 2009; Neugebauer et al. 2016; van Assche et al. 2020; van Assche 2021a, 2021b
System performance	How the policy problem evolves over time and how well previous strategies managed the policy problem before the shock. How previous strategies were shaped by related policy domains.	Farley et al. 2007; O'Donovan 2017
Shock	An exogenous, sudden, rare, harmful, disruptive, and urgent event that (almost) overstretches current coping capacities. It may return repeatedly or persist as a background stressor.	Grossman 2015; Cairney & Jones 2016; Dolan 2021
Risk appraisal	How threatened a person feels by a certain risk. Risk appraisal is composed of a cognitive and an affective subcomponent.	Grothmann & Reusswig 2006; Babicky & Seebauer 2019; Kuhlicke et al. 2020
Coping appraisal	The cognitive process by which a person evaluates possible responses that may reduce the perceived threat. Coping appraisal includes the three subcomponents response efficacy, self-efficacy, and response costs.	Grothmann & Reusswig 2006; Babicky & Seebauer 2019; Kuhlicke et al. 2020

Non-protective responses	Responses aiming to avoid or suppress the emotional consequences of the threat or the allocation of responsibility for preventing the threat.	Grothmann & Reusswig 2006; Babicky & Seebauer 2019; Kuhlicke et al. 2020
Individual reactions	Responses during recovery from the shock and prevention of recurring similar shocks.	Kuhlicke et al. 2020; Seebauer & Babicky 2021; Noll et al. 2021
Actor coalitions	Actor coalitions are groups of individuals with decision power, such as elected officials, individual citizens, civil servants, or representatives of interest groups. These groups coordinate to pursue congruent policy narratives.	Sabatier 1988, 2007; Zahariadis 2007; Oborn et al. 2011; Candel & Biesbroek 2016
Policy entrepreneurs	Policy entrepreneurs are individuals who lobby for their favored policy narrative and form actor coalitions. Policy entrepreneurs need not have decision power.	Sabatier 1988, 2007; Zahariadis 2007; Oborn et al. 2011; Candel & Biesbroek 2016

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## 2.1 Strategy development: From problems to paper

The first phase of the SSIR framework maps out how policy strategies are developed. In the 1970s, the **strategy** concept gained popularity in management studies focusing on the level of organizations (van Assche et al. 2021b). This strand of literature understands a strategy as “some sort of consciously intended course of action” such as a plan or guideline to deal with a specific problem (Mintzberg 1987, p. 11). An opposing understanding to “strategies as plan” emerged from the so-called learning school (e.g., Mintzberg et al., 1976), which portrays “strategies as practice” (Steurer 2007; Golsorkhi et al. 2010). According to that perspective, strategies are found in all spheres of society, and the strategizing of individuals, organizations, communities, or states never stops (van Assche et al. 2020).

Within the context of governance, the concept of strategies has gained more attention in recent years, particularly in the field of environmental policy and planning where the great challenges of the 21st century require long-term policy solutions (Matheson 2009; van Assche et al. 2020; van Assche et al. 2021a; 2021b). Examples of international strategies with higher-level policy objectives are the Sendai Framework on Disaster Risk Reduction and the COP21 Paris Agreement on climate change. In governance, strategies are described as “a vision for a desirable longer-term future” (van Assche et al. 2020, p. 696) of different public and private actors that is based on collectively binding decisions (e.g., consensus or a democratic majority) on how to get there.

Strategies need not always result from a deliberate plan, however. Building on Mintzberg’s (1987) typology of strategies, we distinguish intended from emerging strategies. While **intended** strategies are purposefully developed to address a policy problem, strategies can also **emerge** in the absence of intentions as a “pattern in a stream of actions” (Mintzberg 1987, p. 12). Emergent strategies also result from unexpected opportunities or ad-hoc solutions to isolated cases of a policy problem that are consistently replicated and transferred to other similar contexts (Mintzberg & Waters 1985). Most strategies contain both intended and emergent elements, however (Neugebauer et al. 2016). Finally, some strategies remain **unrealized** and are discarded; for instance, because they cannot compete with other strategies that are better aligned with the dominant policy narratives or better address the policy problem.

Strategy research has been criticized for its measurement and operationalization of the strategy concept (Ginsberg 1984). To better grasp this concept, van Assche et al. (2020) introduce the institutional and the discursive dimensions of strategies. The institutional dimension proposes that strategies depend on and are shaped by institutions, which coordinate and integrate different discourses and actions of public and private actors in different policy domains (van Assche et al. 2020; van Assche et al. 2021b). At higher levels of governance and especially in the case of cross-cutting and transboundary policy problems such as climate change, food security, or sustainable development, more coordination and integration towards a shared goal is required (Candel & Biesbroek 2016; Peters 2018; Biesbroek & Candel 2019). Once a strategy has been institutionalized, it becomes a tool of governance, and institutions are tasked with coordinating the strategy (van Assche et al. 2021a). The discursive dimension describes a collective narrative, vision, or perspective about a desirable future and how to get there (van Assche et al. 2020; van Assche et al. 2021b).

**Policy narratives** reflect worldviews of different actors, which structure and convey their understanding of the nature and causes of a policy problem and the potential policy solutions that could be included in a strategy, but also connect these specific views with their general ideology, identity and policy beliefs (Jones et al. 2014). Narratives come to the fore under conditions of deep uncertainty; they may align and reinforce strategic action by diverse actors (Constantino & Weber 2021). In the case of natural hazards, policy narratives could appear in the mental models of experts (risk as the combination of hazard, exposure, and vulnerability; IPCC 2014) and laypeople (perception

of risk as dreadful, unknown, or uncontrollable; Slovic 1987). Research on the role of narratives in public policy processes distinguishes between narrative form and content in order to identify generalizable and context-independent elements of policy narratives (McBeth et al. 2005; Shanahan et al. 2011; Shanahan et al. 2013; Jones et al. 2014; Crow & Jones 2018). Narrative form refers to a set of fixed elements such as setting, characters, plot, and moral of the story, but the narrative content is mostly relative to a specific context.

These narrative elements are rooted, inter alia, in **policy beliefs**, that is, a set of values that follows a systematic pattern (Sabatier 1988; Jones et al. 2014). Policy beliefs reflect core principles and commitments actors have based on their own norms, values, and ideas that determine their preferences regarding a specific problem (Sabatier 1988; Biesbroek 2021; Kammermann & Angst 2021). Policy actors take action based on the shared set of beliefs (Zhou et al. 2021). Within the SSIR framework, policy beliefs are the element most distant from manifest action in the real world and may therefore seem too abstract to measure; however, established belief system theories suggest generalizable dimensions which underlie belief tendencies. The Cultural Theory of Risk posits that groups of people share the same interpretations of human-environment relations which leads to cultural biases in the perception, evaluation, and management of risk (Douglas & Wildavsky 1983; Thompson 1980; Wildavsky & Dake 1990). These beliefs are structured along the cross-cutting dimensions “group” (strong vs. weak preferences of belonging to a group) and “grid” (strong vs. weak social obligation to distinct roles, rules, and structures). In a similar vein, Cultural Cognition Theory (Kahan et al. 2007, 2008, 2011) posits an individualism-communitarianism dimension (orientation toward weak vs. strong group membership, encompassing beliefs that problems should be solved by the market vs. the state) and an egalitarianism-hierarchy dimension (orientation toward weak vs. strong social stratification to distinct roles, emphasizing moral principles vs. upholding rules and regulations; Hartmann 2010, 2011). Policy beliefs and narratives are fairly stable compared to policy strategies, which constitutes a challenge for policy coordination and integration if new policies run counter to established beliefs (Hall 1993; Pierson 1993); yet, there are examples of narratives changing over time, such as the adoption of fishery concerns within EU development cooperation policy which realized mutual synergies with respect to improving livelihoods and food security (Candel et al. 2015).

In strategy development, different policy actors stand out who want their beliefs and worldviews reflected in policy outcomes (Zhou et al. 2021). Policy beliefs are presumed to orient a group and act as a glue and driving force behind advocacy coalitions (Sabatier 1988; Zhou et al. 2021). **Actor coalitions** are groups of policy actors from different institutions and backgrounds such as elected officials, individual citizens, civil servants, or representatives of interest groups, who share a set of policy beliefs and have decision power (Sabatier 2007). Some individuals or corporate actors – so-called **policy entrepreneurs** (Kingdon 1984) – lobby for their favored policy narrative, build actor coalitions and networks, and finally, seize the opportunity to initiate action after a policy window has opened (Zahariadis 2007; Oborn et al. 2011). While policy entrepreneurs do not have decision power themselves, they play a crucial role in shaping the context and content of policy development, in capturing the attention of policymakers, and in bridging local problems from narrow thematic areas to broad, cross-cutting issues (Zahariadis 2007; Oborn et al. 2011; Candel & Biesbroek 2016).

Policy actors operate at multiple governance levels in order to increase policy flexibility and efficiency, as compared to centralized authorities (Marks & Hooghe 2000). Multi-level governance has grown in importance over the last decades and can be organized into two different types. The first type is characterized by shared power between governments representing clearly defined territories such as nation states and regional governments (Liesbet & Gary 2003). In this type, the development of policy strategies typically follows a nested approach such that lower-level strategies aim to be coherent with higher --level strategies. This type is common in the European Union, where policy reforms initiated



and pushed at the supra-national level are to be transposed to national and regional levels (Cunha & Swinbank 2009). The second type of multi-level governance starts from the policy problem, and power and decision-making are dispersed between multiple affected levels. Low entry thresholds to be part of this governance structure and highly flexible organization are characteristic of this type (Liesbet & Gary 2003). This type results in problem-driven policy strategies that emerge from close collaboration between concerned actors, while external interactions are kept to a minimum. A prominent example of this type is the governing of the commons (Ostrom 2015).

Most policy problems do not appear entirely unexpectedly but evolve and are addressed over time. **System performance** reflects the pre-shock history of how the problem has manifested as the discrepancy between actual conditions and stated objectives, and how the problem has been dealt with as long as shocks were absent (Farley et al. 2007; O'Donovan 2017). System performance comprises the repeated occurrence or accumulation of small hazard events, as well as the incremental policy steps taken to cope with these small events. In addition, system performance includes processes of policy learning, if earlier policy decisions are revisited in the light of new information (O'Donovan 2017), and policy integration, if strategies are shaped by related or adjacent policy domains (Solecki & Michaels 1994). System performance can be monitored with specific indicators that track objectives over time. These indicators should not, however, be mistaken for neutral criteria; since indicators monitor objectives that are derived from policy narratives, indicators are also colored by what is deemed important in the dominant policy narratives (Dolan 2021).

## 2.2 Strategy application: From paper to action

The second phase of the SSIR framework describes how strategies are implemented after a shock. A **shock** is an exogenous, sudden, rare, harmful, disruptive, and urgent event that (almost) overstretches current coping capacities (Grossman 2015; Dolan 2021). A shock is exogenous as it originates outside the political system under study (Cairney & Jones 2016; Hanger-Kopp et al. 2022); thus, routine events such as periodic elections, regular turnover in institutions, or budget deadlines do not qualify as shocks (Beland & Howlett 2016; Dolan 2021). A shock may be anticipated but its exact timing is random. A shock conveys urgency, as it leads to time compression by speeding up the development and application of strategies (Grossman 2015). Shocks should not be overrated in their relevance; a shock alone rarely suffices to propel an issue to enduring prominence (Solecki & Michaels 1994).

Some policy problems do not culminate in singular shock events, however. Slow-onset issues like drought and climate change persist as background stressors, incurring continuous degradation or system underperformance that amounts to a shock once the accumulated shortfalls become unbearable (Grossman 2015). The SSIR framework is tailored to rare and outstanding events, however; slow-onset issues often give rise to reciprocal framing contests between system performance and policy narratives, which makes it hard to disentangle directional influences (Dolan 2021).

Shocks typically open a policy window. A policy window is a temporary period of rapid policy evolution; during this period, existing policy arrangements are disrupted as they are designed only for managing routine fluctuations in system performance (Penning-Rowsell et al. 2006; Jones et al. 2016). During a policy window, the likelihood of developing new strategies is higher than usual (Solecki & Michaels 1994). When the window opens, public and policy attention turns the spotlight onto the underlying causes of the problem and may challenge or reframe the dominant policy narratives (Bubeck et al. 2017; Rose et al. 2020). Actors strive for fast recovery and symptomatic relief and may draw on large resource inflows that had not been available prior to the shock, for instance, international aid funds or private donations (Penning-Rowsell et al. 2006; Birkmann et al. 2010; Brundiers & Eakin 2018). Once the most visible and pressing issues have been resolved, actor engagement winds down because

continued activity no longer yields significant returns (although the problem may still be unresolved), and the policy window eventually closes (Solecki & Michaels 1994; Farley et al. 2007; Grossman 2015).

Radical and catalytic change that questions core beliefs and agendas happens rarely during the timespan from the opening to the closing of a policy window after a shock, however (Solecki & Michaels 1994). Instead, policy windows tend to accelerate or modify ongoing change, by amplifying existing ideas and pre-signals (Johnson et al. 2005; Thaler et al. 2020), by instigating renegotiation of leadership and institutional roles (Birkmann et al. 2010), by extending or elaborating current strategies (Solecki & Michaels 1994), or by shifting policy narratives to favor a particular approach or product (Kulmer et al. 2022).

Once a policy window has opened, policy actors are confronted with the need to act (Mintzberg 1987). An **implemented strategy** includes a series of activities undertaken by the government to achieve the stated goals and objectives, realizing the policy solutions prescribed by the strategy. Implemented strategies include land use plans, laws, or government subsidies and directly affect households or businesses. The implemented strategy is either **unchanged** with only marginal amendments or omission of selected policy solutions; **revised** with substantial reorientation or expansion; or newly **emerging** due to a shock. A strategy can also **fail** and not be implemented, for instance, if it is expected to underperform when applied to the current shock.

Policy strategies can be implemented at multiple governance levels. Coordination and integration between and across levels are important to avoid redundancies and gaps (Peters 1998) and to overcome challenges related to fragmentation, incoherence, or inconsistency (Candel & Biesbroek 2016). Policy coordination and integration problems are addressed either through the restricted number of involved actors (in the first type of organization in multi-level governance) or the limited engagement with unconcerned actors (in the second type; Scharpf 1994; Liesbet & Gary 2003). In both types, competencies are distributed such that the costs of heterogeneity are balanced by economic benefits of scale. Transaction costs of gathering and disclosing information, reaching consensus and decisions, and maintaining infrastructure will be kept low (Marks & Hooghe 2000). To some extent, however, redundancies ensure the reliability, flexibility, and quality enhancement of an implemented strategy (Landau 1969, Peters 2018). These redundancies may help in dealing with shocks since they provide a “creative potential” (Landau 1969, p. 356) or room for maneuver, in particular when facing high uncertainties.

### 2.3 Strategy impact: From action to reaction

The third phase addresses how an implemented strategy translates into reactions of households and businesses to the problem. The SSIR framework posits an indirect relationship: implementing the strategy does not directly incur individual reactions, but changes the underlying motivations and perceptions, which subsequently lead to specific individual reactions. The SSIR framework draws on Protection Motivation Theory (PMT; Rogers 1983) to describe how individual reactions result from motivations and perceptions. The PMT is an established action theory that has been applied to a range of natural hazards, including droughts (Truelove et al. 2015), landslides (Mertens et al. 2018), tornados (Weinstein et al. 2000), volcanic hazards (Covey et al. 2019), wildfires (Martin et al. 2008) and most prominently floods (Grothmann & Reusswig 2006; Kuhlicke et al. 2020). The PMT may explain reactions from diverse individual actors such as households (Babcicky & Seebauer 2019), farmers (Mitter et al. 2019), or local authorities (Grothmann et al. 2013).

According to the PMT, individual reactions arise from the interaction between risk appraisal, coping appraisal, and non-protective responses. **Risk appraisal** indicates how threatened a household or business feels by a certain risk. Risk appraisal is composed of a cognitive (risk perception as the expectancy value of probability and severity of negative outcomes) and an affective (feelings of fear

and worry) subcomponent. An implemented strategy may influence risk appraisal, for instance, by informing how likely and how severely the shock may return, by countering misperceptions, or by contextualizing individual shock experiences. **Coping appraisal** indicates how an actor evaluates possible responses that may reduce the perceived risk. Coping appraisal includes the three subcomponents response efficacy, self-efficacy, and response costs. Response efficacy describes how effective a protective action is considered in reducing the expected negative outcome. Self-efficacy refers to the perceived ability to carry out this protective action. Response costs capture the financial resources, time, and effort required to implement the action. An implemented strategy may influence the efficacy and costs of individual reactions by means of financial schemes, voluntary or mandatory guidelines, counseling, or other instruments.

The risk and coping appraisal processes interact: Without a significant risk appraisal, actors would not see any need to take action. If high risk appraisal coincides with high coping appraisal, protective reactions are initiated. If high risk appraisal meets low coping appraisal, actors may feel overwhelmed and instead turn to non-protective responses. **Non-protective responses** are avoidant or suppressing reactions in order to downplay the risk (e.g., denial, wishful thinking) or to shift responsibility (e.g., fatalism, overreaching reliance on external support; Bubeck et al. 2013; Babicky & Seebauer 2019). An implemented strategy that takes comprehensive governmental steps to mitigate the shock impacts may make people disregard their personal contribution, or policies of promise and appeasement may encourage denial and wishful thinking.

The PMT is well suited to explain reactions that include a subjective balancing of costs and benefits (Kuhlicke et al. 2020); however, the PMT should not be misconstrued as covering all motivational determinants of individual reactions. In the example of floods, further relevant factors are past experiences of hazard events (Osberghaus 2017; Thistlethwaite et al. 2018) or the influence of the social environment (Poussin et al. 2014; Bubeck et al. 2018). The SSIR framework focuses on risk appraisal, coping appraisal, and non-protective responses, though, because these factors are well confirmed in the pertinent literature and can be directly targeted in an implemented strategy.

The PMT is open to being applied to any kind of **individual reaction**; however, the strength of influence of risk appraisal, coping appraisal, and non-protective responses may vary between individual reactions. For instance, in the case of flood preparedness, the impact of risk appraisal is small (Bubeck et al. 2012; Bamberg et al. 2017), whereas coping appraisal plays an essential role (van Valkengoed & Steg 2019; Noll et al. 2021). While risk appraisal refers to the general, overarching threat, the impact of coping appraisal depends on the specific reaction considered (Babicky & Seebauer 2019; Noll et al. 2021).

The SSIR framework does not specify which particular individual reactions stand at the endpoint of the framework's three phases; however, for the purpose of applying the SSIR framework in adaptation research, we propose transformation, maladaptation, backfire, and inaction as prototypical individual reactions. These four prototypical reactions may appear during recovery from a shock and prevention of recurring similar shocks and may illustrate possible (mis-)directions in integrating climate change adaptation and mitigation.

Transformation ("build back better") aims to improve a system's resilience to withstand shocks (Folke et al. 2016) or fundamentally (but not necessarily irreversibly) change the nature of a system that is no longer tenable (Walker et al. 2004). Transformation is also characterized by integrating and leveraging synergies between climate change adaptation and mitigation, and by catering to previously underrepresented policy objectives. It can take place at individual, collective and regional levels (Park et al. 2012) and expands the scope of action to indirect consequences of the shock and to possible overlaps with other domains by considering a system's "double exposure" (O'Brien & Leichenko 2000).

Examples of transformation reactions are modifications of production systems or income diversification.

Maladaptation (“build back short-sighted”) can be defined as intended actions that restrict their scope to the direct, short-term consequences of the shock and lead to an increase in vulnerability or deteriorate the conditions for sustainable future development (Juhola et al. 2016). It includes adopting quick end-of-pipe fixes to remedy the most pressing problems as well as implementing corrections that barely counter ongoing degradation and that are insufficient to accommodate future shocks. An example of a maladaptation reaction is business operations focused on optimizing cost margin and gaining competitive advantage in narrow market segments at the expense of overall resilience.

Backfire (“build back worse”) refers to reactions that undermine instead of reconciling climate change adaptation and mitigation, or ignore or condone negative environmental externalities and other side-effects in order to achieve highly selective business or policy objectives. Examples of backfire reactions are expansions in business operations to compensate for losses, resulting in, for instance, additional greenhouse gas emissions or higher assets at risk. Backfire also manifests as Jevon’s Paradox or rebound effect, when savings from more efficient provision of services by technology modernization are (over-)compensated by subsequent increases in consumption (Sorrell 2007; Gomez & Pérez Blanco 2014).

Inaction (“build back as before”) refers to the active or implicit decision to not perform actions (or to postpone actions indefinitely) that go beyond those already agreed upon before the shock happened. Uncertainties are often used as an excuse for remaining inactive (Howden et al. 2007; Gifford 2011). Inaction is characterized by restoring the essence of the incumbent system to the pre-shock status, by depreciating damages or ignoring sunk costs, by rebuilding without improvements towards climate change adaptation or mitigation, by remaining in inertia or with entrenched habits, and by continuing business-as-usual despite evidence that shocks will occur more frequently and more severely in the future.

### 3 Applying the SSIR framework

In order to illustrate how phases and elements link to each other, we apply the SSIR framework to two examples. Both examples describe potential adaptation policies in the housing sector, that is, policies combining climate change adaptation and mitigation. The first example, planned relocation from flood hazard zones, is intended to reduce flood risk and may also promote rebuilding in an energy-efficient manner. The second example, building renovation, pursues reductions in heating energy demand and carbon emissions, and may also support keeping homes cool during urban heat waves. Biesbroek & Candel’s (2019) empirical comparison of the Dutch food and climate change adaptation policy is closely aligned with the first phase of the SSIR framework and highlights the issue of policy (dis-)integration and coordination in the case of cross-cutting policy problems. Dutch food policy, on the one hand, is inadequate to address current challenges of system performance, foremost the ecological sustainability, public health, and robustness of modern-day food systems; Dutch adaptation policy, on the other hand, is fragmented by sectoral perspectives on spatial planning or water management and lacks a holistic approach.

#### 3.1 Planned relocation

During **phase 1** of the SSIR framework, the policy problem manifested in an increasing number of buildings constructed in floodplains that were repeatedly affected by floods, indicating insufficient **system performance**. Moving buildings from high-risk flood hazard zones to no-risk zones was considered a **policy strategy** for adapting to this risk (Schindelegger 2019). Planned relocation is used across the globe, for example, in Austria, the United States of America, Australia, Vietnam, Japan, and

Mozambique (Correa et al. 2011; de Sherbinin et al. 2011; Sipe & Vella 2014; UNHCR 2014; Kloos & Baumert 2015; Bukvic & Owen 2017; Barnett & McMichael 2018; Seebauer & Winkler 2020). Most communities resist this radical strategy, though, and instead turn towards other, less contested risk reduction measures (Thaler et al. 2020). The dominant **policy narrative** in flood risk management centered on cost-benefit assessments (Slavikova et al. 2021). Planned relocation adhered to this narrative because the one-time investment for removing old and constructing new buildings pays off to a great extent by precluding any repeated flood damages in the future. Low-income communities with less valuable assets in monetary terms may, however, be unfairly subjected to planned relocation because alternatives in risk reduction yield a negative or low cost-benefit ratio (Siders 2019). Planned relocation also matched with the narrative of shifting responsibility to homeowners as the state is no longer willing or able to provide comprehensive protection for everyone (Kuhlicke et al. 2020), and with the narrative of ‘room for the rivers’ and ‘making space for water’ in the risk management discourse (Warner & van Buuren 2011). The narrative in flood risk management was based on hierarchical **policy beliefs**, where the voluntary relocation of individual residents was combined with technical engineering solutions that cover a large area and are pushed by governmental authorities (Thaler et al. 2020).

In line with **phase 2**, planned relocation was usually implemented after a **shock**, such as the floods in Austria in 2002 or 2013, New Orleans in 2005, post-tsunami Tohoku in Japan in 2011, or Germany in 2016 (Iuchi 2014; Mayr et al. 2020; Thaler et al. 2020). In Austria, policymakers used the 2013 flood event as a policy window to **implement the strategy** as a financial compensation scheme (Schindelegger 2019; Thaler et al. 2020). The Austrian government offered all residents in the relocated Danube community up to 80% of the value of the old building and the demolition costs (Thaler et al. 2020). The strategy used in Austria in 2013 was mostly **unchanged** as it had already been developed and implemented in adjacent downstream areas in 2002. By contrast, in Simbach in Germany in 2016, households were relocated as an **emergent** strategy as no previous plans had existed but the public administration used the momentum in the aftermath of the flood (Mayr et al. 2020). In two examples of **revised** strategies, the planned relocation was combined with climate change mitigation strategies: In Valmeyer in the United States of America and Abruzzi in Italy, planned relocation also served to increase biodiversity in the abandoned areas, improve individual wellbeing, and encourage a transformation process towards low emissions (Knobloch 2006; Micangeli et al. 2013).

In **phase 3**, relocation programs met the individual considerations of flood-prone households. In Austria, the **risk and coping appraisal** in the decision to leave or remain in the flood risk zone centered on emotional reasons on the one hand, such as traumatic flood memories and a personal bond to the place, and financial restrictions on the other hand, such as uncertain income and family prospects (Seebauer & Winkler 2020). **Non-protective responses** appeared as feeling helpless and impotent against an uncertain yet overwhelming flood threat and against powerful state actors (Thaler et al. 2020). The potential **individual reactions** span all four prototypical reactions mentioned in section 2.3. As a transformation reaction, the new building could be constructed as a zero- or low-emission building that at the same time is designed to withstand natural hazard events. Examples are the solar city in Valmeyer, Illinois (United States of America; Knobloch 2006) or the sustainable energy supply system in the L’Aquila municipality (Italy; Micangeli et al. 2013). Individuals may act in a maladaptive way when rebuilding their homes with only piecemeal adaptation measures or close to their previous place of residence, at the fringe of, or even inside the flood risk zone (Nalau & Handmer 2018). Backfire occurred in the Austrian case when new buildings were developed at a larger size, including swimming pools or other energy and carbon-intensive amenities (Thaler & Fuchs 2020). Both maladaptation and backfire reactions could be avoided by mandating flood-proof, eco-friendly rebuilding standards in the relocation strategy, or by linking financial compensations not just with risk reduction but also with energy efficiency. Most voluntary relocation programs result in partial inaction if a large part of the

community ignores the implemented strategy and refuses to relocate, thus remaining at risk in the floodplain, raising public costs for maintaining infrastructure in the risk zone, and blocking the use of the zone for water retention. Restoring a building destroyed by flooding to its previous state without any improvements towards climate change adaptation or mitigation would also represent an inaction reaction.

### 3.2 Building renovation

According to **phase 1** of the SSIR framework, the **system performance** clearly highlighted the policy problem that the thermal performance of the existing housing stock was insufficient and that widespread refurbishment was necessary, including insulating walls and roofs, installing double- or triple-glazed windows or retrofitting fossil-fuel heating systems. International and national climate monitoring continued to report that current efforts did not comply with carbon emission reduction targets (Umweltbundesamt 2021). In parallel, repeated heat waves increased heat stress and morbidity, in particular among vulnerable groups such as the elderly or people with cardiovascular and respiratory diseases; as a drastic example, the 2003 heat wave in Western Europe led to 70,000 premature deaths (Kjellstrom et al. 2016). Well-insulated residential housing provides the double benefit of reducing heating demand in winter and keeping the building interior cool in summer. Consequently, **policy strategies** in Austria, the focus country of this example, called for extended efforts in building renovation, for instance in climate and energy strategies (BMWFJ & BMLFUW 2010, Bundeskanzleramt 2013) and heat protection plans (BMLFUW 2012, City of Vienna 2015). The dominant **policy narrative** was that the public sector should incentivize the renovation of privately-owned buildings. In contrast to the construction of new buildings, where increasingly strict energy standards were mandated (OIB 2019), renovating existing buildings was voluntary. This stemmed from **policy beliefs** in market forces, on the one hand, arguing that the role of policy just lies in providing subsidies to shorten the amortization period of efficiency investments, and in the sanctity of private property, on the other hand, arguing that policy should not impose restrictions on private possessions that had already been taxed and approved.

**Phase 2** commenced with the **shock** of the 2008 global financial crisis. This shock was exogenous, sudden, and disruptive, as it severely affected all economic sectors and most market actors had not anticipated when and how hard the crisis would hit. The Austrian government **implemented** a subsidy program for building retrofitting, mainly to support the construction industry (Amann et al. 2014); thus, as the economy recovered, subsidy budgets were cut substantially after 2014 (Seebauer et al. 2019). The original strategy remained basically **unchanged**: Because of voluntary participation and funding rates of ca. 30% of total renovation costs, the implemented strategy mainly reached mid- to high-income homeowners who could afford upfront investment costs (Schleich 2019). Despite continued subsidy provision, the retrofitting rate is still below policy targets (Umweltbundesamt 2021). In 2021, the program was **revised** by offering a 100% funding rate to low-income households in order to improve equal access to the program; however, it is still only homeowners who may apply, even though most low-income households are tenants (Seebauer et al. 2021). A similar renovation subsidy program in Italy even offered a 110% funding rate (Governo Italiano 2020). A possible future **emergent** strategy could be the inclusion of innovations in building technology in the funding criteria, for instance offering higher subsidies if recyclable and locally produced insulation materials made from straw are used.

In **Phase 3**, the renovation subsidy program intersected with the motivations and perceptions of households and thereby induced specific individual reactions. The **risk appraisal** was low: At this time, heating costs did not heavily burden household incomes, and energy poverty rates were lower than in other European countries (Statistik Austria & E-Control 2021); heat waves were not considered a severe threat (Babcicky & Seebauer 2016). The **coping appraisal** for renovating one's home depended



on available capital for covering upfront investment costs, ownership status, and replacement opportunities when the old fossil heating system broke down (Hecher et al. 2017). Thus, a frequent **non-protective response** was to shift the responsibility for structural improvements of buildings to landlords or housing associations. Against this motivational background, we may outline how the implemented strategy led to different **individual reactions** which advance or hinder adaptation outcomes: A transformation reaction would be full retrofitting of the entire building envelope, combined with a heat pump that also cools in summer and with façade greening or shading. Linking the renovation subsidy program with funding schemes for urban greening could incentivize this transformation reaction. A maladaptation reaction would be quick and partial insulation measures retaining the old heating system, which is then overdimensioned for the reduced heating demand; since 2011, the Austrian subsidy program also funds partial retrofits, which may have unintentionally promoted this reaction. Other possible maladaptation reactions are installing a more fuel-efficient burner but still heating with oil or natural gas; or installing energy-intensive air conditioning. Backfire reactions would be heating to warmer room temperatures because it is cheaper after the retrofit (Sorrell 2007), or taking the subsidy as a windfall profit when the home would have been remodeled anyway because of changed domestic needs (Wilson et al. 2015, Seebauer et al. 2019). Inaction reactions would be refraining from any structural improvement of the building and bearing the full brunt of climate change, heat waves, and energy prices. Another inaction reaction would be adopting only everyday behaviors for energy saving (e.g. keeping the doors between heated and unheated rooms closed, dressing warmer rather than turning up the heating) or heat-adapted routines (e.g., using window blinds, shifting leisure activities to cooler daytimes); however, everyday behaviors are much less enduring and effective than structural modifications. Moreover, self-imposed austerity such as cutting heating to a bare minimum may hit vulnerable and marginalized households disproportionately (Eisfeld & Seebauer 2021).

## 4 Discussion and conclusions

The Strategy Shock Implementation Reaction (SSIR) framework illustrates how a shock converts an intended into an implemented strategy and how this conversion is a critical factor in how a policy strategy impacts individual reactions. Thus, the SSIR's added value is twofold: First, the framework highlights that governmental action can indeed shape and guide individual reactions, but only if strategies are designed to hold under different conditions and shocks. Second, the framework reconceptualizes the role of shocks from mere policy windows to policy filters; in other words, that shocks do not just enable and accelerate, but create and modify actions by governments and households or businesses. The SSIR framework may structure retrospective, historical research that aims to reconstruct why individual reactions occurred against the background of a historically grown policy environment, both in a rather stable hierarchical policy structure or in more dynamic problem-centric policies; however, the framework may also guide prospective, forward-looking studies that aim to anticipate how current policy strategies will perform when put to the test by a shock. Prospective and retrospective research could be combined, for instance, if an intended strategy is designed to cope with specific shock scenarios defined by impact modeling, and the viability of both strategy and scenarios are evaluated once an actual shock occurs. Throughout, the framework requires an interdisciplinary set of concepts and methods on how policy strategies are developed, implemented, and reacted to, drawing on political science, psychology, economics, risk management, and much more. By design, the SSIR framework is generic and can be applied to other fields besides climate policy and adaptation presented here.

As the SSIR framework tracks policy strategies over the three phases of development, application, and impact, it raises research questions about how policy strategies evolve and function over time. First, the framework proposes that policy narratives persist throughout the process of deploying policy

strategies in practice and that these narratives continue to shape a strategy once it has been implemented. Research in this direction could retrace which narratives come to the fore at which critical points in a strategy's evolution (intended, emergent, unchanged, revised), why some narratives prevail over others, whether the predominant narratives affect the governance level responsible for the strategy, and whether traces of narratives are still recognizable once a strategy has been implemented and its activities and instruments have been adopted by households and businesses.

Second, the framework points to shocks as moments of change that turn intended strategies into implemented strategies, instigate revision, or introduce emergent aspects to the strategy. Shocks can have an enormous impact on intended strategies, especially if the activities and instruments envisaged in the strategy cannot deliver an effective response. Research in this direction could disassemble policy strategies and analyze which of their functional parts are reframed and reoriented when they meet the harsh reality of managing the consequences of a shock. This research could detail whether the scope of a shock determines at which governance level a strategy is implemented; for instance, lower governance levels could be expected to react faster because of lower coordination efforts.

A particular type of shock of interest in the SSIR framework could be 'run-up' shocks which are anticipated long before they happen and yet an adequate intended strategy is absent. Examples of run-up shocks are the widening discrepancies between trained workforce and demand in elderly care, between the employed adding to and the retired withdrawing from pension funds, or between teacher shortage and education needs. In these examples, reliable demographic data indicate when the system will eventually collapse, yet with only minimal intended strategies in place, in the moment of actual system collapse, a radical strategy will have to emerge. Research in this direction could compare the formation of emergent strategies in run-up versus unexpected shocks.

Third, the framework depicts individual reactions as the endpoint of the strategy process. How households or businesses cope with current and prepare for future shocks depends, inter alia, on the policy environment they live in. Policy strategies trickle down to individual reactions, past the filters of shock and implementation. Research in this direction could reconstruct how early policy beliefs and narratives remain as residue in implemented strategies and still guide individual reactions to a shock.

In line with its interdisciplinary and generic focus, research using the SSIR framework should draw on a broad mixed-method portfolio. Strategy evolution over time could be reconstructed by analyzing consecutive versions of strategy documents. Interviewing stakeholders who developed and implemented the strategy could elicit their policy beliefs and policy narratives, for instance by asking about worldviews and preconceptions as to why a policy problem exists and what could be done about it. Interviews might be helpful to identify informal, unrealized, and failed strategies not covered by written sources; therein, retired officials might be more open interviewees than active personnel. Comparing different regions where the same strategy was implemented could show the influence of regional shock characteristics. Tracking signature phrases in documents or audiovisual media could analyze how specific policy narratives persist, reappear, or are reframed during the strategy process. Surveying households or businesses on their motivations and perceptions could indicate how an implemented strategy (and by extension its precursors of intended strategy, narratives and beliefs) enters individual decision making.

Due to its nature as a conceptual abstraction, the SSIR framework is inherently limited in representing the complex reality. For parsimony, the framework assumes a unidirectional causal sequence centered on a single policy problem, a single strategy, and a single shock. In reality, however, there are continuous feedback loops between the different elements and between governance levels. For instance, strategy implementation may boost or devalue specific policy narratives; policy evaluation after a shock may inform strategy development; or widespread maladaptive reactions by individuals



may degrade system performance. In practice, policy strategies do not stand alone but give overarching directions for a set of related problems and are parallel, complementary, or competing with other strategies on other governance levels in related policy domains. In interconnected social, economic, and ecological systems, policy problems and shocks typically interact with, and even propagate each other at various temporal and spatial levels. When developing and applying strategies, higher governance levels need to be respectful of lower-level regulations, arrangements or agreements to allow for effective management of common resources. Ongoing and recurrent events in system performance may be hard to disentangle from accumulated small shocks and make it difficult to define the onset, severity, and end of shocks. The SSIR framework assigns main actors to each of the three phases, but these actors may interact throughout the entire process. For instance, households and businesses may build political leverage as early as in phase 1 by means of lobbying and grassroots initiatives to push their preferred policy narratives and shape intended strategies.

Nevertheless, the SSIR framework may provide structure and directions for empirical research in the disarray and complexity of real-world climate change adaptation and mitigation policy and other policy domains. We would welcome future empirical applications and theoretical amendments of the SSIR framework to expand on the aspect of policy coordination and integration. Cross-cutting policy problems, such as climate change adaptation at local to international levels, require more coordination and integration, but the policy elements to be integrated need not move in a concerted manner but may develop at different paces or even in opposite directions (Candel & Biesbroek 2016, 2019). Empirical evidence on successful response strategies to shocks that are vertically and horizontally coordinated and integrated would be most welcome – vertically by facilitating interactions between higher and lower governance levels (e.g., information flows, resource allocation; both bottom-up and top-down), horizontally by producing agreements between organizations at the same governance level who deal with specific aspects of the policy problem. Tracking how interrelated strategies evolve in parallel at multiple governance levels and to what extent they intersect when encountering specific shocks, could deepen our understanding of the dynamic development of policy strategies for transformative recovery.

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