

Ortiz-Riomalo, Juan Felipe; Koessler, Ann-Kathrin; Engel, Stefanie

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Fostering co-operation through participation in natural resource management

An integrative review

Juan Felipe Ortiz-Riomalo,^{1,2} Ann-Kathrin Koessler³ and Stefanie Engel^{2, 4}

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Abstract: Solving humanity's social-environmental challenges calls for co-operation by the relevant actors. Hence, involving them in the policy process has been deemed both necessary and promising. But how and to what extent can participatory policy interventions effectively foster co-operation for sustainable natural resource management? Research on collective action and research on participatory governance offer insights on this question but have hitherto remained largely unconnected. In particular, results of field and lab experiments on collective action can complement those of case studies on participatory governance to shed further light on the potential (institutional and behavioural) impacts and mechanisms of participatory interventions. This article reviews and integrates key insights of these strands of research using the Institutional Analysis and Development (IAD) framework. Our review shows that participatory interventions can foster co-operation (a) by helping the relevant actors craft adequate institutional arrangements, and (b) by addressing and/or influencing relevant actors' attributes (i.e. their individual and shared understandings, beliefs, trust and preferences). However, to fulfil their potential, organisers of participatory interventions need to soundly design and implement them, adequately embedding them in the broader context. They must be complemented with proper follow-up, enforcement and conflict-resolution mechanisms to nurture, reassure and sustain trust and co-operation.

Keywords: co-operation, collective action, social dilemmas, participatory governance, natural resource management.

JEL: D72, D79, P32, P48

¹ Corresponding author: juanfelipe.ortizrioma@uni-osnabrueck.de (ORCID ID: 0000-0003-4275-687X)

² Professorship of Environmental Economics, School of Business Administration and Economics and Institute of Environmental Systems Research (IUSF, Research Centre), Osnabrück University.

³ Institute of Environmental Planning, Leibniz University Hannover. (ORCID ID: 0000-0002-8516-2900).

⁴ ORCID ID: 0000-0002-3568-5500.

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1. Introduction

Resolving the pressing environmental challenges of our time calls for collective action (NRC 2002; Ostrom 2010a; Muradian and Cardenas 2015; IPCC 2019; Dasgupta 2021). The relevant involved actors must coordinate to attain socially desirable goals such as biodiversity conservation, water provision and food security. Although feasible in principle, self-organised collective action for sustainable natural resource use and management does not always occur. In such instances, externally led *participatory interventions*—i.e. those policy interventions that involve the relevant actors via consultation, information and/or active engagement in the policy process (Fung 2006; Reed 2008; NRC 2008; Newig et al. 2018)—could foster collective action (e.g. Ostrom 1990, 2010b; Baland and Platteau 1996; Pahl-Wostl 2002, 2015; Meinzen-Dick et al. 2018). In fact, multilateral organisations, global treaties, national legislation and a number of scholars stress the importance of relevant actors participating in collective action for environmental protection and natural resource management (e.g. UNCED 1992; UNECE 1998; Dietz et al. 2003; Engel 2004; Depoe et al. 2004; NRC 2008; ECLAC 2018). From somewhat different angles, two strands of research provide insights into the specific potential impacts of participatory interventions on institutions, decision-making processes and operational action. The first focuses on the contextual, situational and behavioural determinants of collective action and the second strand focuses on the impacts and mechanisms of participatory governance. Albeit related, the two have largely evolved in parallel and remained unconnected, missing opportunities for cross-fertilization. This article contributes to integrating insights from both strands within a common conceptual framework and thus enriching our understanding of the potentials and mechanisms of participatory interventions.

The literature on collective action draws upon case studies, social science experiments, and game-theory modelling to shed light on the central variables and general principles for the relevant actors to build governance systems that foster and sustain trust and co-operation in natural resource use and management (e.g. Ostrom 2000a; Ostrom et al. 1994; Poteete et al. 2010). This scholarship has thus brought to the fore the centrality of participatory decision-making to nurture trust and generate suitable and legitimate solutions to complex collective-action challenges (e.g. Baland and Platteau 1996; Ostrom 1990, 2006, 2007a, 2010b; Cox et al. 2010; DeCaro et al. 2015; Heikkila and Andersson 2018). But participatory processes take different forms (Reed 2008; NRC 2008; Newig et al. 2018; Reed et al. 2018), and to the best

of our knowledge research on collective action has not systematically analysed the variations and effects of different forms and features of participatory interventions.

Conversely, the literature on participatory governance conceptualises, describes and analyses the features, methods, context and outcomes of *participatory processes*—i.e. the series of activities created and facilitated by participatory interventions through different possible *participatory methods*, such as participatory modelling, serious games and group deliberation. It does so primarily through case studies, literature reviews and meta-analyses using cases largely from Europe and North America. Results indicate that participatory process outcomes hinge on their design, methods and fit (e.g. Beierle and Cayford 2002; Reed 2008; NRC 2008; Gerlak et al. 2013; Bodin 2017; Reed et al. 2018). Yet, more research is still needed to understand better how, and in which conditions, participatory processes can generate substantial and sustained change in institutional arrangements, patterns of behaviour and critical social-ecological outcomes (Koontz and Thomas 2006; Newig and Fritsch 2009; Carr et al. 2012; Gerlak et al. 2013; Bodin 2017; Jager et al. 2020). Case studies cannot easily track all outcome variables because relevant outcomes of participatory processes often do not immediately materialise. Furthermore, such outcomes are influenced by ecological, social and institutional factors for which individual case studies cannot control (Beierle and Cayford 2002; NRC 2008; Jager et al. 2020). Case-study research does help researchers to provide rich descriptions of processes, contexts and potential outcomes, but not to neatly establish causality and assess the relative importance of specific contextual, situational and behavioural factors (Collier 1993; Poteete et al. 2010). Furthermore, the use of different conceptual and methodological frameworks for each case study limits the extent to which meta-analyses can help overcome these limitations (Rudel 2008; Poteete et al. 2010).

Experimental approaches, which have been amply applied in research on collective action, can help to identify and disentangle the specific institutional and behavioural impacts and mechanisms of (different types of) participatory interventions (e.g. Cavalcanti et al. 2013; Meinzen-Dick et al. 2018; Alpízar et al. 2019; Ortiz-Riomalo et al. 2022a). Ethical, institutional, political and/or logistical constraints limit the feasibility of randomised controlled experiments and, hence, a broader experimental evidence base on participatory processes for sustainable resource management (NRC 2008). Nevertheless, researchers and analysts can already draw valuable insights from lab and lab-in-the-field experiments on co-operation in collective-action challenges (e.g. Baland and Platteau 1996; Ostrom 2006; NRC 2008; Ortiz-

Riomalo et al. 2022a). True, the systematic study of the impacts and mechanisms of participatory interventions has not been their main goal. Nevertheless, these experiments recreate the types of processes that participatory interventions commonly facilitate (e.g. collective decision-making and small-group communication) and assess their impacts on actual co-operative action, such as the provision of public goods and the maintenance of common-pool resources in tightly controlled recreations of collective-action challenges (i.e. social dilemma situations). They allow connecting collective-choice processes concerning the design of institutional arrangements with other relevant behavioural outcomes, such as beliefs and preferences, and to concrete actions ‘on the ground’, such as contributions to the maintenance of the commons in the real world (e.g. Ostrom et al. 1994; Ostrom 2006, 2010b; Poteete et al. 2010; Janssen et al. 2010; Cardenas 2011). In all, the experimental approach implies a high degree of control over the data generation process, allowing to isolate the effects of incentives or alternative institutions and policy approaches, such as participatory interventions, on behavioural outcomes (Smith 1982; Kagel and Roth 1995, 2016). These insights are difficult to garner by relying solely on field data about actual participatory interventions and processes.

Based on these considerations, we review and synthesize insights mainly coming from experiments on collective-action challenges in tandem with those coming from the case study research on participatory processes. We aim at expanding the understanding of the potential of participatory interventions for collective action in the context of natural resource management and its enabling conditions. In doing so, we lay the groundwork for a way forward in natural resource management research and practice that encompasses both participatory governance and collective action.

In light of the scope of this paper, the breadth of these two distinct yet related research streams and the wide variety of research designs and conceptual approaches, we opted for an extensive, narrative review and synthesis of key insights instead of a systematic literature review or meta-analysis (Bangert-Drowns 1995; Rudel 2008; Poteete et al. 2010). To focus on the main patterns each stream of research has noted in the data, we primarily focus on the review papers and meta-analyses available in each literature strand. And within the literature on collective action, we focus on the insights garnered through lab and lab-in-the-field experiments to delve into the specific behavioural outcomes that participatory interventions could deliver. To collect and organise the existing insights within a common coherent framework, we draw on the Institutional Analysis and Development (IAD) framework (Kiser

and Ostrom 1982, 1987; Polski and Ostrom 1999; Ostrom and Ostrom 2004; Ostrom 2005, 2007a, 2010b, 2011; McGinnis 2011a), combining it with its conceptual extensions (e.g. Cole et al. 2019; Epstein et al. 2020)—namely, the Network of (Adjacent) Action Situations (NAS) framework (McGinnis 2011b; Kimmich 2013) and the Social-Ecological Systems (SES) framework (McGinnis and Ostrom 2014; Schlager and Cox 2018)—and with key concepts on participatory governance (Beierle and Cayford 2002; Rowe and Frewer 2000, 2005; Fung 2006; Newig et al. 2018; Pahl-Wostl 2009; Pahl-Wostl et al. 2010; Reed et al. 2018).⁵

In Section 2, we present the conceptual framework guiding our review. The framework outlines two channels in which participatory interventions can foster collective action: (a) the governance system, comprised of institutional processes and arrangements, and (b) the attributes of the relevant actors. We review the insights on each of these channels in Sections 3 and 4, respectively. In Section 5, we discuss the conditions that tend to enable or hinder participatory interventions in fulfilling their potential. Section 6 concludes the review.

2. Conceptual framework

Individual and collective interests are often at odds in collective-action challenges such as those posed by biodiversity conservation and climate change mitigation and adaptation. In such situations, which are also referred to as social dilemmas, solely pursuing individual material interests leads to socially undesirable outcomes (Dawes 1980; Sally 1995; Kollock 1998; Ostrom 1998, 2010c). Whether actors can coordinate their behaviour to achieve better collective outcomes depends on the actors' attributes, the structure of their action situation (AS) and the attributes of the broader social, biophysical and governance. The IAD, NAS and SES frameworks, used in combination, help to organise these elements within a common framework (Ostrom 2005, 2010b, 2011; McGinnis 2011a, 2011b; Poteete et al. 2010; Heikkila and Andersson 2018; Schlager and Cox 2018; Cole et al. 2019). Together with the concepts and insights of the literature on participatory governance (Beierle and Cayford 2002; Fung 2006; NRC 2008; Newig et al. 2018; Reed et al. 2018), they integrate the conceptual framework that guides our review, whose elements we expound in this section. Figure 1, in the end of the section, provides a summary.

⁵ For applications of these frameworks to the study of real-world policy processes (including participatory and resource management decentralization processes) and the review of insights coming from empirical research, we refer the interested reader to Pahl-Wostl et al. (2010), Pahl-Wostl (2015), Klok and Denters (2018), Cárdenas and Ortiz-Riomalo (2018), Brisbois et al. (2018), Epstein et al. (2020) and Ortiz-Riomalo et al. (2022a and 2022b).

2.1. Action situation(s)

An AS is the analytical focal unit of the IAD framework. It is where state and/or non-state individuals or organisations interact (e.g. exchange information, co-operate) and produce joint social-ecological and institutional outcomes (Ostrom 1990, 2005, 2011; Schlager and Cox 2018; Cole et al. 2019). The basic working components of an AS are what is typically reflected by a game or decision situation in game theory and experimental economics (Ostrom et al. 1994; Ostrom 2005, 2011). Thus, in a given AS, depending on their *position* or role, the involved *actors* (i.e. the participants of the situation) decide among different possible *actions* based on their information about the other involved actors, their positions and possible actions, the potential *outcomes*, *costs* and *benefits* of these actions, and their degree of *control and influence* over actions and outcomes. Actors, positions, actions, information, outcomes, costs and benefits, and degree of control and influence are the seven basic working components structuring any AS (Ostrom 2011; McGinnis 2011a). (See the blue part, the AS box in Figure 1.)

A focal AS is, in turn, part of a network of adjacent action situations (NAS), in which the outcomes of one AS influence the structure of another AS (Ostrom 2005; McGinnis 2011b; Kimmich 2013; Cole et al. 2019). Actors may adapt their behaviour and adjust their strategies based on evaluating the outcomes of their actions in a given AS. Through different levels of learning processes, they can for instance adjust their day-to-day operational choices in an operational AS. Alternatively, or additionally, in the corresponding formal or informal AS for institutional design they can seek to change the current institutional arrangements that regulate these choices in order to attain better outcomes for themselves and the others (Ostrom 1990, 2005; Pahl-Wostl 2009; Pahl-Wostl et al. 2010; McGinnis 2011a). A series of pre-existing biophysical conditions, governance systems and actors' attributes shape the structure of any focal (N)AS, thus marking actors' constraints and possibilities for collective action (Cole et al. 2019). These contextual conditions are illustrated by the green part, the Contextual conditions box in Figure 1, and discussed in detail next.

2.2. Contextual conditions

2.2.1. Biophysical conditions: the resource system

The biophysical conditions refer to the ecological and physical characteristics of the resource system. Thus, the existing human-made physical infrastructure, such as facilities for

the storage of resource units (e.g. a water reservoir), are also part of it (Ostrom 2007b; Cole et al. 2019).

2.2.2. Governance system: institutional arrangements and processes

Formal and informal institutional arrangements, in the form of rules, norms and shared strategies, also influence actors' (operational and institutional) choices, actions and interactions (North 1994; Crawford and Ostrom 1995; Ostrom 2005). *Operational-choice* arrangements, such as public policies on environmental and resource management, regulate actors' day-to-day operational choices and actions, defining how resource users must, must not, may or should use natural resources.⁶ *Institutional-choice* arrangements define how actors can craft, enforce and modify their current institutional arrangements, and who can participate in the process.⁷ These arrangements and the processes for crafting and enforcing them constitute the governance system (Ostrom 1990, 2005, 2011; Poteete et al. 2010; McGinnis and Ostrom 2014; Cole et al. 2019).

2.2.3. Actor's attributes

Actors' choices and actions are also conditional on their own attributes (Kiser and Ostrom 1987; Ostrom 2005, 2011). Here we can first distinguish among different individual attributes that influence decisions: actors' information, knowledge, mental models, beliefs, preferences and individual decision-making rules. In addition, we can distinguish broader socioeconomic and sociocultural attributes that are the physical, human and social resources which actors can draw upon for their choices and actions, such as physical and financial assets, education, mutual trust and social networks (ibid; Ostrom et al. 1994; Dasgupta 1999).

As the relevant theoretical and empirical literature has indicated, actors' preferences and beliefs play a key role in collective action (Bates 1988; Kollock 1998; Fehr and Fischbacher 2002; Fischbacher and Gächter 2010; Chaudhuri et al. 2017; Ostrom 2010c; Poteete et al. 2010;

⁶ Commonly known as operational rules (e.g. economic, environmental and natural resource use policies and regulations). We rather use the term 'arrangements' to acknowledge that norms and shared strategies, besides rules, also constitute institutional arrangements (Crawford and Ostrom 1995; Ostrom 2005).

⁷ The framework differentiates further between collective-choice and constitutional-choice arrangements (Ostrom 2005). The term 'institutional-choice arrangements' encompasses both (Ostrom 1990). Collective-choice arrangements (e.g. arrangements to regulate the policy-making process) define how collective choice comes about; that is, how operational arrangements must, may or should be crafted, enforced and changed by the relevant actors. Constitutional-choice arrangements (e.g. a country's constitution, an organisation's by-laws) define the participants and procedures that are allowed to transform, monitor and enforce the collective choice arrangements (Kiser and Ostrom 1982).

Pavitt 2018). Mental models and *beliefs* refer to actors' *understandings* and expectations about cause-and-effect relationships and about the likely behaviour and beliefs and expectations of other actors (Geanakoplos et al. 1989; Mantzavinos et al. 2004; Bowles 2016; Bicchieri 2017). From others' feedback and the biophysical context, actors individually and collectively learn and adapt. They may revise their individual and shared understandings and beliefs about individual and shared strategies, norms and rules, potentially yielding better individual and collective outcomes (North 1994; Mantzavinos et al. 2004; Ostrom 2005, 2014; Pahl-Wostl 2009; Poteete et al. 2010; Schill et al. 2019). Nevertheless, actors' limited information-processing capabilities can hamper such learning (North 1994; Ostrom 2005, 2010c; Poteete et al. 2010)

Actors' *preferences* define their valuations of different decision and action options (Sen 1977, 1997; Ostrom 2005). Different types of preferences underpin people's choices and actions (Bosworth et al. 2016; Dhimi 2016). *Social preferences* imply that actor may not only care for their own social and economic outcomes but also for the state of their ecological environment (i.e. the state of nature), the norms they and the others have learned to value, and the outcomes, actions, intentions, beliefs and expectations of other actors (Ostrom 2010c; Cardenas 2011, 2018; Bowles and Polanía-Reyes 2012; Bicchieri 2017; Heinz and Koessler 2021). Whereas *other-regarding preferences* "attach value to the [outcomes, i.e. the] wellbeing of others as ends in themselves (other humans, species or nature as a whole)" (Heinz and Koessler 2021), *self-regarding preferences* primarily attach value to the individual well-being, i.e. to the (material) outcomes of the individual decision-maker (Cox 2004; Dhimi 2016). People may also care about the features of the underlying decision-making processes and thus form *procedural preferences* (Dhimi 2016). Many tend to prefer decision-making processes they perceive as fair and legitimate, and processes that make them feel self-determined. That is, processes that allows them to control and influence their potential actions, choices and outcomes, making them feel competent, autonomous and connected with the social-ecological environment (Tyler 1990; Sen 1997; Ostrom 2000; Frey et al. 2004; Bowles 2008, 2016; Dal Bó 2014; DeCaro et al. 2015; Ezzine-de-Blas et al. 2019).

Actors with these different types of preferences may then favour collective action out of different reasons. Because they value collective action in itself, care for the image they can project to themselves and the others, care for others' well-being, expect to attain better social-ecological outcomes for themselves and/or the others and/or value norms of e.g. fairness, co-operation or reciprocity in themselves, they would rather act in favour of collectively desirable

outcomes (Andreoni 1988; Fehr and Fischbacher 2002; Batson and Powell 2003; Fehr and Schmidt 2006; Ostrom 2010c; Poteete et al. 2010; Cardenas 2011, 2018; Bosworth et al. 2016). However, joint, coordinated action is often the only way for attaining better outcomes for all in interdependent settings such as the ones collective-action challenges create. In these types of settings, people acting in favour of the collective may end up being worse-off if the other relevant actors decide not to co-operate (Kollock 1998; Ostrom 1998, 2010c). Hence, a non-negligible proportion of people have been shown to act as conditional co-operators (Fehr and Fischbacher 2002; Fehr and Schmidt 2006). That is, they co-operate only if others do. For these, the beliefs about others' actions are crucial determinants of their own behaviour (ibid; Fischbacher and Gächter 2010). Thus, if they trust that others will engage in collective action, and value co-operation or co-operative outcomes, they tend to also co-operate (Gambetta 1990; Baland and Platteau 1996; Dasgupta 1999; Ostrom 1998, 1999, 2010c; Cox 2004; Fischbacher and Gächter 2010; Chaudhuri et al. 2017; Andreozzi et al. 2020). In other words, it matters whether they find the other relevant actors trustworthy or not (Ostrom 1998, 2010c; Chaudhuri 2011).

To a large extent, belief formation and trust are based on the information actors have about their situation and broader context. This includes, first, the information on the other actors' attributes (e.g. preferences, intentions, past actions in similar situations). And it also includes the information on their possibilities and constraints, i.e. the potential monetary and non-monetary costs and benefits of (defecting on) collective action (Dasgupta 1990, 2007, 2021; Gambetta 1990; Ostrom 1999, 2010c). The structure of the AS they are part of, the adjacent AS and the pre-existing contextual conditions thus influence trust and thereby collective action (ibid; Baland and Platteau 1996; Ostrom 2010c). Hence, the IAD framework and its conceptual extensions also lay out critical variables that a policy intervention can influence to generate the conditions that foster and sustain trust and collective action (e.g. Ostrom et al. 1994; Poteete et al. 2010; Heikkila and Andersson 2018).

2.3. Potential of (participatory) policy interventions for collective action

Based on the main elements of the framework and previous contributions from institutional and behavioural economics (e.g. Ostrom et al. 1994; Ostrom 2010b; Bowles 2016; Bosworth et al. 2016; Cardenas 2018; Heinz and Koessler 2021; Koessler and Engel 2021; Velez and Moros 2021), we can thus distinguish two channels through which participatory policy interventions could foster collective action: by addressing and/or changing the attributes of (a)

the governance system and/or (b) the relevant actors (e.g. preferences and beliefs). Through these channels participatory interventions can influence any of the working components and thus shape the structure of the focal (N)AS that determines the prospects of collective action for sustainable natural resource management in a given social-ecological system. Figure 1 illustrates the two channels in adjacent orange boxes and arrows.

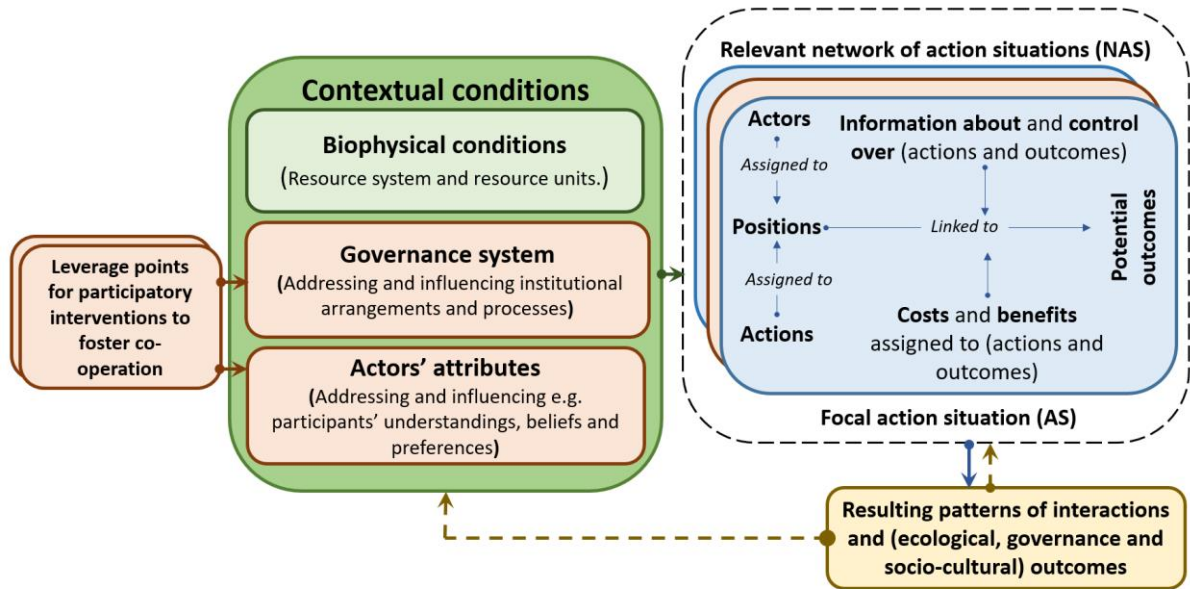


Figure 1: Conceptual Framework

The elements in the blue, ‘focal action situation (AS)’ box correspond to the working components of any AS. These are influenced and/or determined by the pre-existing contextual conditions (green box). Layers behind the blue box represent adjacent AS for institutional and/or operational choice and action. By creating new AS or influencing existing AS, participatory processes can address and influence the governance system and/or the actors’ attributes that would subsequently shape the prospects for collective action at the institutional and/or operational levels. *Source:* Adapted from E. Ostrom (2005, 2010b and 2011), McGinnis and Ostrom (2014) and Cole et al. (2019).

The following three sections review and integrate the insights of the two strands of literature, particularly regarding the potential impacts of participatory interventions via the governance system (in Section 3) and actor’s attributes (in Section 4). Each section first reviews the insights from the literature on participatory governance which help map out the potential impacts and underlying mechanisms. In turn, insights from the experiments on collective action shed further light on the extent to which, and the ways by which participatory processes address and/or influence the governance system and actors’ attributes, potentially generating substantial and sustained change in current institutional arrangements and behavioural patterns. Section 5 summarises the main caveats to these insights; that is, the enabling conditions for participatory interventions to fulfil their potential.

3. Potential impacts via the governance system

Field studies indicate that participatory processes have the potential to convene the relevant state and non-state actors for them to exchange different sources of knowledge, information and perspectives and reach common understandings and agreements on suitable institutional arrangements, such as binding regulations, management plans and/or non-binding policy recommendations concerning the use and management of natural resources and the environment (i.e. the focal, operational AS) (Beierle 2002; Beierle and Cayford 2002; Koontz and Thomas 2006; Reed 2008; NRC 2008; Newig and Fritsch 2009; Fritsch and Newig 2012; Newig et al. 2019; Jager et al. 2020). To achieve this, participatory interventions can apply an ample set of methods (e.g. participatory modelling, participatory planning, vision-building exercises, serious games).⁸

Moreover, field study evidence also suggests that the agreed-upon arrangements could potentially have higher rates of acceptance and compliance than external policy interventions. In particular, participatory interventions that define and communicate their objectives and rationales clearly, involve the relevant actors, draw upon sufficient expertise and scientific knowledge, and grant participants enough influence at the appropriate stage of the process are likely to produce suitable, credible and legitimate outcomes (Beierle and Cayford 2002; Fung 2006; Reed 2008; NRC 2008; Newig and Fritsch 2009; Fritsch and Newig 2012). They can also help the relevant actors anticipate critical aspects for the design, monitoring and enforcement of the institutional arrangements being crafted (Newig and Fritsch 2009). Therefore, participatory interventions have greater potential to garner otherwise dispersed resources, such as knowledge and personnel, facilitate collaboration and co-production, avoid contestation, increase acceptance and compliance and eventually deliver socially desirable, legitimate outcomes at both the institutional and operational levels (Ostrom 1996, 2000b; NRC 2008; Ansell and Gash 2008; Newig and Fritsch 2009; Gerlak et al. 2013; Fung 2015).

However, participatory processes may fail to ensure high social-ecological standards in the measures that participants eventually agree (e.g. NRC 2008; Maestre-Andrés et al. 2018). The insights we review in Section 5 indicate that the final outcome largely depend on the context and the design of the participatory intervention. Moreover, in this stream of research there are no conclusive insights establishing clear connections between the outcomes of

⁸ Van Asselt Marjolein and Rijkens-Klomp (2002), Pahl-Wostl and Hare (2004), Rowe and Frewer (2005), Kallis et al. (2006), Lynam et al. (2007), NRC (2008), Voinov and Bousquet (2010) and Medema et al. (2016) review, categorise and/or analyse some of these different methods extensively.

participatory processes and actual co-operation in other relevant institutional and operation action situations. In other words, there is not enough evidence causally connecting participatory interventions with substantial changes in relevant operational institutional arrangements, behavioural patterns and social-ecological outcomes—also noted elsewhere in the literature (e.g. Beierle and Cayford 2002; Koontz and Thomas 2006; NRC 2008; Gerlak et al. 2013; Bodin 2017; Jager et al. 2020).

Experiments on collective action show that participatory interventions can indeed facilitate the adoption of institutional arrangements with the potential to effectively improve co-operation ‘on the ground’. They also show that this potential is not guaranteed, nevertheless. On the one hand, experiments showcase groups of participants who can devise (explicit or implicit agreements on) rules and joint strategies to ensure the provision of a public good or the maintenance of a common resource if they have opportunities to participate, e.g. to vote and communicate (Ostrom et al. 1992, 1994; Ostrom 1998, 2006; Cardenas 2011; Dal Bó 2014; Dannenberg and Gallier 2020; Koessler et al. 2021a). Furthermore, institutional arrangements that favour socially desirable outcomes, if chosen, tend to improve actual co-operation more when participants choose them than when the experimenters (i.e. the ‘external authorities’) impose them (Dal Bó et al. 2010; Dal Bó 2014; Dannenberg and Gallier 2020). And in experiments with communication, participants cannot only reach non-binding agreements on desirable shared strategies but also abide by them, even in the absence of external enforcement (Ostrom et al. 1992, 1994; Cardenas et al. 2000; Ostrom 2006; Balliet 2010; Koessler et al. 2021a). Indeed, communication can potentially help participants generate levels of co-operation that match or exceed those that externally imposed efficiency-enhancing rules generate (Cardenas et al. 2000; Cardenas 2004; Rodríguez-Sickert et al. 2008; Abatayo and Lynham 2016).⁹

On the other hand, these experiments also display a non-negligible fraction of participants who fail to vote for or communicate to devise socially optimal rules (e.g. Ostrom 1992; Janssen et al. 2014; Dal Bó et al. 2010; Cardenas et al. 2011; Dannenberg and Gallier 2020). And even if they manage to agree on a (non-binding) set of socially desirable set of rules and strategies, one single vote or opportunity to communicate may not suffice to enforce them and sustain co-operation over iterative interactions (e.g. Ledyard 1995; Cardenas et al. 2004; Kroll et al. 2007;

⁹ Moreover, the elements comprising participants’ communication in experiments also tend to resemble those of actual participatory deliberative exercises (Fung 2003; Delli Carpini et al. 2004; Dryzek et al. 2019; Koessler et al. 2021a), supporting deliberation’s potential for socially desirable social-ecological outcomes.

Chaudhuri 2011). Additional monitoring and enforcement mechanisms and provisions shall be warranted.

In Section 5 we pick up and expound on the general challenge that participatory processes face to ensure and sustain co-operation and socially desirable outcomes, and also delve into potential strategies for organisers and sponsors to tackle these challenges through sound process design and implementation. But first, in Section 4 we review insights that show how the realisation of the potential of participatory interventions for collective action also rests upon the impact that they may ultimately have on key actors' attributes.

4. Potential impacts via actors' attributes

Both streams of literature suggest that well-designed participatory interventions can also facilitate individual and collective learning processes and address influence participants' preferences. The resulting changes in actors' attributes can then also promote collective action at the institutional and operational levels. We expound on these insights in the following starting with the literature on participatory governance.

Case studies of participatory processes indicate that the convened actors can acquire, exchange and assimilate new relevant information and perspectives on the social-ecological challenges they face, the broader consequences that their actions may have on themselves, others and the environment, and the possible strategies to attain better collective outcomes (Beierle and Cayford 2002; Pahl-Wostl and Hare 2004; NRC 2008; Lejano and Ingram 2009; Newig et al. 2019). This would facilitate individual and collective learning processes in which participants would reach new or revised individual and shared understandings, increasing their capabilities to design and carry out suitable strategies for socially desirable outcomes (Beierle 1999; Fung 2006; NRC 2008; Pahl-Wostl 2009, 2015; Scholz et al. 2014; Newig et al. 2019; Kimmich et al. 2019; Jager et al. 2020).

Furthermore, the evidence from the scholarship on participatory governance indicates that processes that define and communicate their aims and rationales clearly, involve all relevant actors effectively and facilitate fruitful, often intensive face-to-face interactions can induce actors to trust, especially in the willingness of other (state-)actors to co-operate and deliver on their promises (Chess and Purcell 1999 in Reed 2008; see also Beierle and Cayford 2002; Pahl-Wostl and Hare 2004; Reed 2008; Fritsch and Newig 2012; Jager et al. 2020). Processes that allow participants to understand their common challenges, specify concrete possible solutions,

clarify the potential joint benefits of collective action and effectively influence the course and outcomes of the participatory process would be particularly effective at trust-building (*ibid*), even in challenging contexts with high initial levels of mistrust and entrenched disagreements (Beierle and Cayford 2002; NRC 2008; Jager et al. 2020).

Therefore, the evidence from research on participatory governance presented so far in this and the previous section suggests that participatory processes can also foster collective action by leveraging on participants' social preferences, including other-regarding preferences and procedural preferences (Reed 2008; NRC 2008; Newig and Fritsch 2009; Jager et al. 2020). They influence participants' perceptions on the legitimacy and credibility of the decision-making process and its outcomes, and their expectations about others' intended actions. Some evidence even suggests that participatory process may alter participants' preferences (e.g. Uphoff 1999; NRC 2008). Cumulating evidence on deliberative processes, for instance, suggests that these types of processes induce participants to revise their opinions and perceptions, as well as the ways they value potential actions and outcomes and assess different possible decision options (Delli Carpini et al. 2004; Kenter et al. 2016; Dryzek et al. 2019).

Experiments on collective action also suggest that participatory interventions can facilitate learning processes in which participants build accurate understandings based on the best available information made accessible to them. When they get the chance to talk in experiments on collective-action challenges, participants spend substantial time trying to create a joint understanding on the common challenge they face and its potential solutions (Ostrom et al. 1992; Cardenas et al. 2004; Pavitt 2018). If participants do not understand the challenge and its possible solutions correctly, or do not have access to the required information to understand it and solve it (e.g. participants' past actions and possible action options), they would struggle to co-operate and improve collective outcomes (Cardenas et al. 2011; Janssen 2013; Janssen et al. 2014; Schill et al. 2016). In fact, experiments have shown that groups of participants that receive expert information on the nature of a complex collective-action challenge and its potential solutions before communicating to one another co-operate more than those groups in which only communication is allowed (Moreno-Sánchez and Maldonado 2010; Saldarriaga et al. 2015).

The evidence coming from experiments on collective action also suggests that participatory processes have the potential to induce participants to examine, reflect upon and revise their beliefs about each other's intentions and expectations about co-operation, thereby

also influencing trust-building. To the best of our knowledge, the impact of specific forms of participatory interventions on these types of beliefs has not been systematically investigated in the literature on participatory governance so far. Experiments suggest, however, that the final effect on these beliefs depends on the types and features of the participatory process and the information provided and exchanged by organisers, participants and other relevant actors throughout the process.

During communication in experiments on collective action, participants get to know each other's past actions and their likely preferences, intentions and (normative) expectations by also gathering and exchanging information on past, potential and desirable strategies (Ostrom et al. 1994; Cardenas et al. 2004; Ostrom 1998, 2006, 2010c; Pavitt 2018). Information about the lack of co-operation from some participants would tend to undermine subsequent co-operation—by downgrading participants expectations about others' intentions to co-operate (Ledyard 1995; Fischbacher and Gächter 2010; Janssen 2013; Chaudhuri et al. 2017; Andreozzi et al. 2020). This is in line with the result that a substantial proportion of people act as conditional co-operators (Fischbacher et al. 2001). On the other hand, information on the presence of conditional co-operators (Ostrom 1998, 2010c; Chaudhuri 2011), normative messages on a desired action (Cardenas 2011; Dal Bó and Dal Bó 2014), shaming and guilt-inducing messages (Lopez et al. 2012), and advice by fellow (past) participants to co-operate (Chaudhuri 2011; Koukoulis et al. 2012; Brandts et al. 2016) all tend to motivate participants to co-operate by nurturing optimistic beliefs about others' intended co-operation (Chaudhuri 2011; Dal Bó and Dal Bó 2014; Chaudhuri et al. 2017).¹⁰

Critical for communication to effectively foster co-operation seems to be the exchange of information on specific possible optimal strategies (Lopez and Villamayor-Tomás 2017), the intended co-operation of other actors (Ostrom 1998; Brosig et al. 2003; Cardenas et al. 2004) and normative statements promoting co-operation (Brosig et al. 2003; Janssen et al. 2014; Lopez and Villamayor-Tomás 2017). Just providing or exchanging general information about the problem and its potential solutions, albeit an important element of communication, seems not to be sufficient to increase co-operation (Ostrom 1998; Brosig et al. 2003; Lopez et al.

¹⁰ These messages sent by fellow participants tend to be people-oriented, appeal to participants' emotions, instil group identity and/or promote reciprocal action in favour of co-operation. In contrast, expert advice is problem-oriented, primarily appealing to participants' rationality by 'coldly' depicting their collective-action challenge and its potential solutions. In general, information by fellow participants tends to have higher bearing on participants' action than expert advice (Chetty and Saez 2013; Schill et al. 2016; Brandts et al. 2016); they seem more effective at nurturing optimistic beliefs about others' intentions to co-operate (Chaudhuri 2011).

2012; Brandts et al. 2016; López and Villamayor-Tomás 2017; Pavitt 2018; Koessler et al. 2021a). Generally, this evidence leads to suggest that participatory processes that allow participants to interact in order to realise and reinforce the value of co-operation and make concrete agreements and promises on joint action nurture optimistic beliefs about others' intentions to co-operate, hence fostering trust and actual co-operation thereupon (Ostrom 1998, 1999, 2010c; Fehr and Fischbacher 2002; Cardenas et al. 2004, 2011; Fehr and Schmidt 2006; Chaudhuri 2011; Dal Bó and Dal Bó et al. 2014; Chaudhuri et al. 2017; Pavitt 2018; Koessler et al. 2021a, 2021b).

Finally, there is experimental evidence corroborating the potential impact of participatory processes on collective action via addressing and/or influencing participants preferences. Participatory decision-making has been shown to impact perceptions about the fairness and legitimacy of the policy process and its outcomes (e.g. DeCaro et al. 2015; Liu et al. 2020). Furthermore, participatory processes can potentially activate and/or promote other-regarding preferences by allowing participants to realise the potential consequences of their actions on others and the environment. Experimental evidence suggests indeed that inducing participants to consider the perspective of another actor who can benefit from the participant's action would compel participants to care for and act to the other's benefit (Sally 1995, 2001; Batson et al. 1995; Iris and Bohnet 1999; Czap et al. 2015; Heinz and Koessler 2021; Ortiz-Riomalo et al. 2021; Lejano 2022). In addition, exposing participants to normative messages on the right thing to do may influence, in the first place, participants' beliefs about the likely behaviour and normative expectations of the others, thus addressing social preferences (e.g. Dal Bó and Dal Bó 2014). It may also influence and induce preferences for (conditional) co-operation (Baland and Platteau 1996; Kollock 1998; Cardenas et al. 2004; Ostrom 1998, 2010c; Chaudhuri 2011; Dal Bó and Dal Bó 2014; Pavitt 2018).

The results reviewed in this and the previous section highlight that the impacts of participatory interventions relate to specific design features. They also hint at the pre-existing contextual conditions that usually pose cumbersome challenges to participatory processes if not properly addressed. In the next section we make these aspects explicit, pointing at the main challenges and potential ways to tackle them.

5. Caveats and challenges

Whether participatory interventions fulfil their potential hinges on the degree and the way by which their organisers address the specific context, namely the pre-existing actors' attributes and the relevant governance system. In this section, we review some of the key challenges that successful participatory interventions must consider and overcome through sound design and implementation.

Case studies on participatory governance as well as experiments on collective action both warn that participatory decision-making does not necessarily produce socially desirable outcomes. In some documented cases of participatory processes, the (recommendations for) conservation measures and environmental policy that participants agree upon do not necessarily ensure substantial improvements on current social-ecological outcomes (NRC 2008; Newig and Fritsch 2009; Fritsch and Newig 2012; Gerlak et al. 2013; Bodin 2017). And in experiments on collective action, there are groups of participants that tend not to vote at first sight for rules that guarantee socially optimal outcomes (e.g. Ostrom et al. 1992; Vyrastekova and van Soest 2003; Gülerk et al. 2006; Dal Bó 2014; Dannenberg and Gallier 2020), or fail to reach agreements on joint action for socially optimal outcomes through communication (e.g. Ostrom et al. 1992; Cardenas et al. 2011; Janssen et al. 2014; Schill et al. 2016).

Both streams of research indicate that the attributes of the relevant stakeholders heavily influence the prospects for, and the content of collective agreements on natural resource management. In particular, research on participatory governance indicates that the outcomes of participatory processes could primarily reflect the preferences of the most resourceful, interested and influential actors (Newig and Fritsch 2009; Fritsch and Newig 2012; Gerlak et al. 2013; Maestre-Andrés et al. 2018), neglecting the preferences of less influential actors who are traditionally marginalised and excluded from the policy process (Beierle and Cayford 2002; Koontz and Thomas 2006; Behera and Engel 2007; Reed 2008; NRC 2008; Gerlak et al. 2013). The exclusion of some relevant actors and an uneven representation of preferences and interests would, furthermore, hinder trust-building and compromise the legitimacy of the participatory process and its outcomes (Reed 2008; NRC 2008).¹¹

¹¹ As Ostrom (2006) reviews it, the study by Schmitt et al. (2000) shows that the exclusion of relevant actors hinders the monitoring and enforcing of the agreements that participants reach through communication. Observed deviations from the agreement may originate from the excluded actors' actions and participants can use these outsider actions as scapegoats for their own deviations from the agreement.

Experiments on collective action suggest that heterogeneities among the relevant actors in terms of their initial endowments (e.g. Cardenas 2003; Margreiter et al. 2005; Ostrom 2006; Poteete et al. 2010; Dal Bó et al. 2010; Dal Bó 2014; Schill et al. 2016), positions (e.g., in a watershed; Cardenas et al. 2011, 2015), preferences (Fischbacher et al. 2001; Fischbacher and Gächter 2010; Andreozzi et al. 2020), expectations (Dal Bó 2014; Chaudhuri et al. 2017) and understandings (Schill et al. 2016) tend to encumber collective action. For instance, actors with strong communication and leadership skills tend to impose inaccurate understandings on others, taking them away from socially optimal solutions (Schill et al. 2016). And actors with (unaddressed) concerns and uncertainties regarding the distributive impacts of potential alternative institutional arrangements may not support institutional change even if it contributes to improving co-operation (Kosfeld et al. 2009; Dal Bó 2014; Dannenberg and Gallier 2020).

Now, even if participants reach an agreement on socially desirable institutional arrangements, the levels of collective action a participatory process initially produce may wane over time. An initial agreement on joint strategies may, for instance, not necessarily produce further co-operation to actually implement the agreed-upon strategies on the ground (Beierle and Cayford 2002; NRC 2008; Cavalcanti et al. 2013; Quist et al. 2011). In other words, co-operation throughout the participatory process may not translate into collective action in the relevant institutional and operational action situations outside the participatory process. Generally, experiments show that collective action is feeble. Groups composed of participants with heterogeneous preferences for co-operation—e.g. groups consisting of co-operators, non-co-operators and conditional co-operators—most likely will see co-operation wane as soon as one or some participants deviate from previously agreed-upon or expected co-operative behaviour in successive, subsequent interactions (Ledyard 1995; Fischbacher et al. 2001; Rodríguez-Sickert et al. 2008; Fischbacher and Gächter 2010; Chaudhuri 2011; Chaudhuri et al. 2017).

These are some of the main challenges that the organisers of participatory interventions must tackle through sound design and implementation. Specifically, insights from both streams of research suggest that participatory interventions must ensure adequate involvement of the relevant actors, even-handed and inclusive facilitation of their interactions, and effective recognition and incorporation by the relevant governance system.

Careful actor analysis should allow organisers to identify and characterise the relevant actors—and/or their legitimate representatives—, and then choose and arrange participatory

methods and facilitation techniques accordingly, considering how actors differ on key attributes such as preferences, expectations, demographics, endowments and clout (Reed 2008; NRC 2008; Reed et al. 2009; von Korff et al. 2010). An adequate selection, arrangement and use of methods and techniques should help to handle existing asymmetries fairly, ensuring that the participatory process and its outcomes evenly and effectively involve, considers and reflects all relevant perspectives at the relevant stage of the process (Chess and Purcell 1999; Reed 2008; NRC 2008; Dryzek et al. 2019).¹²

Adequate method selection and deft facilitation should also help to provide opportunities for participants to voice, know, discuss and address each other's preferences and concerns (e.g. about policy trade-offs and distributive impacts). It should also guarantee equitable and effective access to basic accurate social-ecological information (e.g. combining expert advice and peer testimonies) for participants to comprehend the benefits of co-operation and revise their particular standings, understandings and expectations (Vollan 2008; NRC 2008; Moreno-Sánchez and Maldonado 2010; Saldarria-Isaza et al. 2015; Fritsch and Newig 2012; Schill et al. 2016; Jager et al. 2020). Moreover, it should foster productive exchanges among participants in which they build shared understandings, expectations, preferences, explicit agreements and trust in favour of collective action (Ostrom et al. 1994; Ostrom 1998, 2006, 2010c; Cardenas et al. 2004, 2011; Poteete et al. 2010; Pavitt 2018; Koessler et al. 2021a). As noted in the previous section, just providing general information on the basic environmental challenge to address and potential strategies to overcome would be insufficient to effectively boost collective action (Lopez and Villamayor-Tomas 2017; Pavitt 2018; Koessler et al. 2021a)

Finally, the sponsors and organisers of the participatory process should provide for further follow-up, enforcement, monitoring, assessment and conflict-resolution mechanisms to reassure trust and sustain co-operation (Ostrom et al. 1994; Ostrom 2006, 2010b; NRC 2008; Poteete et al. 2010). In experiments, such mechanisms as repeated communication or decentralised sanctioning schemes have been useful in detecting non-co-operators, exerting peer pressure, clarifying misunderstandings, sanctioning defectors and/or reassessing joint strategies, thus sustaining collective action (e.g. Ostrom et al. 1992; Fehr and Gächter 2002;

¹² Careful actor analysis might reveal, for instance, the presence of relevant actors with entrenched positions and trajectories of conflictual interactions, not necessarily interested in co-operating up front. These actors would require special addressing and handling e.g. through bilateral negotiation to fairly incorporate their input (i.e. not at the expense of the rest of participants' interests and preferences) and avoid their potential resistance to, or neglect of the processes and outcomes of the participatory process.

Cardenas et al. 2004; Bochet et al. 2006; Kroll et al. 2007; Dal Bó and Dal Bó 2014; DeCaro et al. 2015). In practice, this entails embedding participatory interventions within the broader governance system (Beierle and Cayford 2002; Ostrom 1990, 2005, 2010b; Edelenbos et al. 2008; NRC 2008; Quist et al. 2011; Pahl-Wostl 2015; Bodin 2017; Klok and Denters 2018; Ortiz-Riomalo et al. 2022b). In this way, other relevant actors, decision-making processes and institutional arrangements do not neglect, collide or ride over the participatory process and its outcomes. Instead, they recognise, allow and/or actively support their follow-up, monitoring, implementation and further development.

6. Conclusion

Previous research on collective action and current legislative frameworks deem stakeholder participation both necessary and promising for co-operation in overcoming complex collective social-environmental challenges. Narrative reviews and meta-analyses of previous research on participatory governance indeed suggest that participatory processes can deliver socially desirable outcomes in natural resource management. However, the evidence causally establishing the potential of participatory interventions to substantially change institutional arrangements, behavioural patterns and critical social-ecological outcomes is rather scant. And the available insights remain largely scattered across distinct yet related strands of literature.

For this article, we reviewed key insights of the literature on participatory governance and the literature on collective action. We focused on the insights coming from meta-analyses and/or literature reviews of the available case studies (for the first stream of research, in particular) and lab and lab-in-the-field experiments (for the second stream of research). We drew on the IAD, NAS and SES frameworks and the concepts from the literature on participatory governance to organise, integrate and synthesize these insights within a common conceptual framework.

In summary, the reviewed insights indicate that well-designed participatory interventions do have the potential to foster co-operation in natural resource management. Participatory interventions often create and structure situations in which users can meet, exchange their knowledge and perspectives and craft adequate institutional arrangements to tackle common challenges. Participatory processes can also address and/or influence key actors' attributes, such as their individual and shared understandings and beliefs, types of preferences and levels

of trust, influencing the chances they have to co-operate for operational institutional arrangements and concrete action for socially desirable outcomes.

Yet, the reviewed insights also indicate that these effects are far from being immediate and guaranteed. They are conditional on the way participatory interventions address and incorporate the relevant context and provide for supplementary follow-up, monitoring and enforcement mechanisms. Interventions that are poorly designed, implemented and supported will likely cause initial patterns of conflicts and cynical beliefs to remain or grow, or initial levels of trust and collective action wane over time. In general, the reviewed literature suggests that the potential of participatory interventions hinges on the way organisers and/or sponsors of participatory processes address the relevant attributes of the context, select and interweave the appropriate participatory methods and embed the intervention within the broader governance system.

By reviewing insights from these streams of research in tandem under a common conceptual framework, this paper contributes to enriching and complementing the picture on the specific institutional and behavioural impacts that participatory interventions can potentially generate, together with the underlying mechanisms that enable or hinder these potentials. Whereas the IAD framework and the insights on participatory governance help to map the general potential impacts and mechanisms of participatory processes, the evidence from collective action experiments adds in support and nuance to these general insights. It backs insights on the potential of participation to deliver (inputs for) suitable and legitimate institutional arrangements and to influence key actors' attributes that condition the prospects for collective action. It also suggests that it would be particularly critical to arrange participatory processes so that they especially nurture and sustain shared understandings, beliefs and preferences in favour of co-operation at both the institutional and operational levels of choice and action. And it indicates that, if properly designed, implemented and supported, processes similar to the ones participatory interventions facilitate (e.g. collective decision-making and deliberation) can actually generate and sustain substantial change in current institutional arrangements and levels of co-operative action 'on the ground'. Which is a causal relationship that research on participatory governance, primarily drawing on case study research, has not been able to neatly establish so far, and hence the experimental evidence helps further illuminate and clarify.

The findings and conclusions of our paper should however be understood as empirically grounded provisional propositions on the potential of participatory interventions—e.g. building blocks for further (middle-range) theories on participatory interventions (Morrow and Muchinsky 1980; Corbin and Strauss 1990; Boudon 1991). Although they synthesize the main patterns, findings and conclusions one can garner from the reviewed streams of research, they come from studies that do not share exactly the same research aims, designs and frameworks. Together with the IAD framework, they can however guide further systematic theoretical and empirical lab and field research aimed at further assessing and developing them. And they can also guide the design of participatory interventions in a way that the chances of desirable outcomes are increased, and further systematic comparisons and assessments among a hopefully increasing number of comparable cases is also facilitated.¹³

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¹³ For an illustration of the kind of approach we are suggesting here for synthesis and comparative analysis, see Beierle and Cayford (2002), NRC (2008), Reed (2008), von Korff et al. (2010), Pahl-Wostl (2015), Newig et al. 2019, Jager et al. (2020) and Ortiz-Riomalo et al. (2022b). The latter uses the IAD, SES and NAS frameworks to garner insights on collective action and participatory governance and apply them to inform the design, implementation and analysis of actual participatory interventions.

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