



**Next Water Governance**

## **DELIVERABLE 7.2**

Methodological approach for co-production  
and learning

**Version 2**

Work Package 7 (WP7): Actionability



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## 1. Scope and specific aims

NeWave aims to “develop research and training for a new generation of future water governance leaders, (...) by equipping them with the transdisciplinary skills to better tackle water challenges.”

In line with the goals of the NeWave project, Work Package 7 *Actionability* aims to encourage water governance early stage researchers (ESRs) to engage with the wider context in which their research takes place, taking into account more inclusive, multifocal and transdisciplinary perspectives. This aim builds from the premise that transforming water governance requires engaging with co-production approaches that enrich the research process and the impact of academic endeavours.

Co-production approaches, as we understand them in the NEWAVE project and, more specifically, under WP7-Actionability where this deliverable is situated, are relevant for those interested in actionable or transformational science, that is, academic pursuits that seek to transform the reality around us towards more equitable and environmentally just outcomes.

ESRs have different goals and use different analytical and methodological approaches. However, most of them seek to actively engage with social actors, policy makers, administrators, economic water users and other stakeholders throughout the research process, in an effort to address complex hydrosocial problems and transform their work into actionable knowledge.

Within NeWave, the goals of Work Package 7 are to:

- a) Trigger involvement of stakeholders at every step of the collaborative research process: the definition of the problems, the methodological approaches, the analysis and choice of alternatives and the implementation and evaluation of the outcomes.
- b) Propose an initial conceptual framework to effectively incorporate participatory approaches and actionable skills in water governance research in all PhD projects.
- c) Design an iterative methodology that allows adjusting means and objectives to the changing reality of social settings of the different ESRs.
- d) Enhance the potential for creative collaborations among the academic and non-academic participants of the Consortium
- e) Draft guidelines, policy briefs and recommendations for policy and extra-academic targets of the project

Objectives (a) and (b) were achieved through Deliverable 7.1 *Knowledge co-production in water governance* (Cabello et al. 2021).

Deliverable 7.2 addresses objectives (c) and (d). It aims to present a methodological approach to follow the work of NeWave Early Stage Researchers (ESRs) throughout their PhD process with regard to actionability and co-production. By systematically recording and supporting their work through different activities – surveys, workshops, consultation sessions, etc. – it is possible to reflect on the challenges and opportunities associated with the development of co-production approaches in the context of a PhD research project, and adapt initial approaches and goals to evolving reality. This has been particularly necessary in the context of the COVID-19 pandemic that has significantly impacted research and field work plans.

Deliverable 7.2 builds on prior work within NeWave Work Package 7. It thus incorporates the content of Deliverable 7.1 on *Knowledge co-production in water governance*, a practical guide that aimed to

support NEWAVE ESRs to structure their research plans from a co-production (transdisciplinary) perspective. That is, an approach that incorporates (interdisciplinary) academics, together with non-academic actors, from the outset and in the different stages of the project: problem definition, identification of research questions, research design, monitoring and evaluation of implementation process, communication or output plan, and interface with the policy arena.

The justification for incorporating the content of Deliverable 7.1 into this document is that D 7.1 was a confidential / internal project deliverable, only available to project partners and Commission services. We believe its content provides the necessary context for the methodological proposal presented in this document and that it can be useful to other ESRs and research networks.

The document is structured in four sections. After this introduction, Section 2 presents the theoretical framework for knowledge co-production as understood in NeWave and that was presented in Deliverable 7.1. Section 3 presents the methodology developed in NeWave to systematically support, follow up and assess the use of co-production methodologies in the context of ESR's PhD projects and enhance the potential for creative collaborations among academic and non-academic actors. Section 4 outlines next steps for NeWave's work on Actionability (WP7).

## 2. Knowledge co-production in water governance

### 2.1. What knowledge is needed for water governance?

Water problems constitute a good example of complex wicked issues, which are characterized by multiple factors, interactions and ways of knowing. Causal relations in hydro-eco-social dynamics often remain difficult to grasp and understand, show delayed cause-effect relationships, both in time and space, exhibit counter-intuitive behaviour, by which the apparent solutions only aggravates the problem, and present high levels of uncertainty (Udovyk and Gilek 2013, Perz et al. 2013). On the other hand, water governance issues are underpinned by the relations between multiple actors with different knowledge and values, usually in situations of deep power asymmetries when not directly in open conflict (Brugnach, 2017). As Zwarteveen et al. (2017) discuss, what makes water uniquely capricious is the entanglement of unequal biophysical, power and expertise distributions.

In our view, understanding and addressing water problems through the lens of complexity requires approaches to generate knowledge that can be effectively used to transform hydro-eco-social systems (Wesselink et al., 2017), and focuses the attention at the interfaces between science, policy, politics and society. There are alternative modes of knowledge production and knowledge use in shaping decisions. These have been developed over the past few decades with contributions from different fields, including biophysical and social sciences (see for example Ison et al. 2011; Ison et al. 2015, Allison et al. 2018; Banos-González et al. 2015, 2016a,b; De Stefano et al. 2016; Elsayah 2020; Fritz and Binder 2020; Schlüter et al. 2019a; Tenza et al. 2019; Tsoukala et al. 2018; Voinov and Bousquet 2010). Table 1, building on Haag (2001), points to some differences between the traditional positivist scientific approach and the complexity paradigm.

Positivist approach	Complexity approach
Well defined theoretical systems	Ill-defined real problems entangled in complex socio-ecological systems. Non-equivalent descriptions are possible. Key role of stakeholders in problem/system definition
Universal	Specific, unique systems
Independent of problem issues	Problem-driven. Modelling for management
Context-free	Context-sensitive
Scientific disciplines, reductionist approach	Inter and trans-disciplinary, holistic approach
Systems to be studied: abstract, simplified, idealized	Systems to be studied: real cases in all their complexity
Very limited consideration (technical) or complete exclusion of uncertainty. Validation/quality control by a close community of experts	Deep consideration of different types of uncertainty, some of which are non-reducible. Extended peer community including stakeholders, which involves a variety of situations such as consensus, dissent and conflict
Straightforward use of scientific knowledge in management. Frequently, in the form of optimization models that assume linear relationships and single	Explicit recognition and increased relevance of values. Valuation procedures involving very different stakeholders and actors.

valuation criteria, defined by a close group of experts	Scientific data and model results as inputs for valuation and decision-making processes, dealing with multiple criteria, alternative valuations, incommensurability and uncertainty
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Table 1 Comparison of different paradigms for knowledge generation and its application in policies and decisions (Modified from Haag 2001)

Regarding the type of knowledge needed to understand water problems from a complex systems perspective, five key features can be highlighted (Martínez-Fernández et al. 2021):

- i. **Problem-based and context-specific approach**, so that knowledge requirements are defined in terms of the concrete problems to be addressed and the questions to be answered (Haag 2001, Banos et al. 2015; Schulter et al. 2019 a,b);
- ii. **Systemic and highly interdisciplinary approach** (Allison et al. 2018, Cairns et al. 2020, Nagatsu et al. 2020). Water governance, as other complex problems, needs a comprehensive, holistic vision to tackle the many interactions, synergies, trade-offs and side effects that are typically found in real-world water problems. This integral vision can only be obtained through highly interdisciplinary approaches. Interdisciplinarity involves not only the integration of different dimensions (ecological, social, hydrological, economic, political, cultural, institutional), but also dialogue and bridges between different conceptual and methodological approaches, as well as quantitative and qualitative information and tools (Max-Neef 2005).
- iii. **Prospective knowledge**. Information about the likely consequences of different policy options is particularly helpful as input for the decision-making process (Banos-Gonzalez et al. 2016, Tenza et al. 2019). In addition to a diagnosis of problems, their causes and consequences, prospective knowledge can provide information on the possible (future) system behaviour under different measures and policy options. This type of information helps anticipate the effects of potential decisions on the different dimensions of the problem and on the goals to be achieved (Banos et al 2016; Hauck et al. 2019; Martínez-Paz et al. 2019). When feasible, this prospective knowledge may benefit from different modelling and simulation approaches, particularly in some complex hydro-eco-social dynamics, like the impact of different measures on the recovery of an overdrafted aquifer or the trade-offs of certain measure on different goals, where simulation can provide a more detailed knowledge about the expected consequences brought about by specific measures and options (Schmitt-Olabisi et al. 2010, Banos et al 2015, Martínez-Fernández et al 2021).
- iv. Explicit consideration of **uncertainty and ignorance**. Uncertainty constitutes a key feature of knowledge about socio-ecological systems and is also an important input in risk assessment. Uncertainty needs to be explicitly considered, including the uncertainty linked to an insufficient knowledge (risks, strict uncertainty, ignorance) and the one emerging as a property inherent to the system (indeterminacy, ambiguity), which constitutes a non-reducible uncertainty (Perz et al. 2013, Banos-Gonzalez et al. 2018, Pagano et al. 2019, Kovacic and Di Felice 2019). The explicit consideration of uncertainty in the process of knowledge generation remains a pending issue in many cases. In the positivist techno-scientific perspective, still mainstream nowadays, uncertainty is negatively valued as something to suppress or disregard. As a consequence, poorly known issues are frequently discarded. This introduces a larger bias on knowledge outcomes than the inclusion of such issues along with

their uncertainties. Moreover, the communication of uncertainty constitutes another pending challenge, because of its negative perception among the general public and some techno-scientific spheres.

- v. ***Co-production (transdisciplinary) approach***, where different actors interact and contribute to the knowledge generation process.

The type of knowledge needed for water governance (problem-based, contextualized, systemic and interdisciplinary, prospective, uncertainty-sensitive, power-laden and co-produced) places additional attention to the processes by which it is produced. The following sections explore the concept of knowledge co-production as a synthesis of several on-going trends that point in the same direction: the inclusion of different actors as relevant knowledge-holders in participatory knowledge generation processes, and the modes by which knowledge is used for shaping policies and decisions.

## 2.2. Knowledge co-production

The concept of knowledge co-production has recently gained traction across a variety of environmental research areas including water, biodiversity, climate change or energy research. It is usually applied to refer to the increasingly diverse and hybrid practices of knowledge generation that move beyond academic boundaries, from the inclusion of indigenous knowledge, to citizen science or the emerging arts-based science (Rathwell et al. 2015). However, the term co-production is also used by other disciplines under different meanings that merit attention to avoid confusion. Miller and Wyborn (2018) describe three main strands of co-production research:

- *Science and Technology Studies* refer to co-production as the means by which science, policy and vernacular knowledge co-construct one another (Jasanoff 2004). In this disciplinary tradition, science is always situated in social contexts and can therefore not be considered as separated from values, politics or culture. The term co-production is here an analytical device to look at the multifaceted relations by which science and society coevolve.
- The *Elinor and Vincent Ostrom school on institutional analysis* and public service delivery was the first coining the term co-production (Ostrom and Ostrom, 1977). They used it to refer to the active participation of citizens in co-producing public service provision such as water supply, security or education. This idea of co-production underpins their later work on institutions and common pool resources.
- *Sustainability science* has put forward the concept of knowledge co-production as a mechanism to advance in the development and implementation of a transformative agenda towards a more sustainable future (see for instance Cornell et al. 2013; Future Earth 2013; 2014). Under this perspective, co-production is seen as a normative aspiration for a new form of knowledge generation that is relevant, robust, actionable and supposedly inclusive (Lepenes et al. 2018 citing Armitage et al. 2011). Co-production is advocated as an effective means to improve the relevance and usability of scientific knowledge in sustainability policies and to increase public trust in scientific and policy institutions (Lemos and Morehouse 2005). The implicit assumption is that the quality of the process of knowledge generation is connected to the quality and impacts of the outputs (Lepenes et al. 2018). The quality of the process is presumed to be enhanced by including those that affect and are affected by the problem under investigation.

It is the notion of knowledge co-production within sustainability sciences that we mostly unpack in this deliverable, yet incorporating insights from other strands. Norström et al. (2020) defined knowledge co-production as an **'iterative and collaborative process involving diverse types of expertise, knowledge and actors to produce context-specific knowledge and pathways towards a sustainable future'**. We consider this definition ample enough to resonate with other terms like participatory research, action research, extreme citizen science, extended peer communities or citizen engagement. Whereas these concepts belong to different scientific traditions and communities of practice, they all align with the emphasis on participatory methods in the generation of knowledge.

## a) State of the art of knowledge co-production in sustainability sciences

The literature on knowledge co-production across sustainability sciences is vast. Multiple heuristic and conceptual frameworks have been developed to analyse and support knowledge co-production. We discuss some works that in our view shed light over different aspects that may be of use for NEWAVE early stage researchers (ESRs).

Bremer and Meisch (2017) offer a rich picture of co-production in climate change research. They first distinguish between descriptive and normative co-production depending on whether it is considered an analytical lens for empirical analysis (as is the case in Science and Technology Studies) or an aspirational pathway for a different social-ecological order (like in the public service and sustainability science traditions). They then unravel those categories to propose the ‘eight-sided prism’ as a plural reading of the different perspectives that are co-producing knowledge on climate services. In this vein, knowledge co-production can be split in five different categories: ‘iterative interaction (between science producers and users)’, ‘extended science (inclusion of different knowledge and values)’, ‘institutional adaptive capacity’, ‘social learning’ and ‘empowerment’. What we find particularly relevant in this work is the invitation for self-reflexivity and theoretical understanding of what researchers ‘buy-into’ when engaging with one of the co-production lenses.

The call for personal reflexivity is common across the knowledge co-production literature. Temper et al. (2019) introduce the concept of political rigour that expands academic rigour with “the application of methods of reflexivity in knowledge creation through which power relations and explicit values and aims of societal transformation are identified, reflected on, socialized and evaluated amongst an extended peer community, and reflected in the research design, methodology and research outputs”. Whether you are more interested in democratizing scientific production, or in working with indigenous communities, support environmental justice struggles, resist oppressive social systems, develop a slow and careful science or facilitate collective processes, you are likely to feel tensions between different roles (such as scientist, activist or facilitator) and values. Political rigour is displayed through an eight cards *Tarot for transgressive research* to help researchers in their inner-looking reflexivity on the strengths and risks of playing multiple roles in their research projects.

For those working with the inclusion of indigenous and local knowledge in research, the *Multiple Evidence Base* and its sequel, *Weaving Knowledge Systems frameworks* (Tengö et al. 2014, 2017), are key references. They challenge the idea of integration among incommensurable knowledge systems. On the contrary, they defend the respect for the integrity of knowledge holders, seeking complementarities and validation mechanisms within and across knowledge systems. Building on several experiences, they draw a five step co-production pathway of mobilization, translation, negotiation, synthesis and application of knowledge that places attention and care to differences and asymmetries between different knowledge systems.

The collaborative and supposedly inclusive knowledge generation experience within the International Panel for Biodiversity and Ecosystem Services (IPBES) has received significant attention from the co-production literature. Iniesta-Arandia et al. (2020) reflect on the challenges of inclusivity bringing insights from feminist and postcolonial studies. They report gender imbalances in working groups, difficulties in having indigenous people participating (instead of researchers with experience in indigenous communities) and challenges in weaving incommensurable knowledge systems when

producing policy reports. They suggest moving beyond binary gender categories and incorporate intersectional lenses in representation norms. They then question the western-science model as criterion for validation of the knowledge to be co-produced in IPBES, to end raising questions on how to design spaces that explicitly address power dynamics or how to work from the idea of situated knowledges paying attention to silences, divergences and diversity in outcomes (Nightingale 2015).

In the field of water management, co-production has been used oftentimes. Brugnach and Ozerol (2019) suggest that authors in this field treat the term as a synonym for transdisciplinarity. That is, the collaborative production of policy-relevant knowledge by different academic and non-academic actors (Lepenies et al. 2018). Relevant analytical frameworks addressing co-production within this field are the work on ambiguity and on multiple ways of knowing water by Brugnach and Ingram (2012) and Brugnach (2017). The crucial role of power inequalities in shaping transdisciplinary efforts within the water sector has been widely documented (Özerol et al. 2018; Scott et al. 2018). Adding to that, the importance of welcoming contested perspectives to the process and navigating conflict and polarization has been signalled (Brugnach 2017; Arsenault et al. 2018). In addition, Lepenies et al (2018) point out that “questions about who has authority and who gets to assert agency, and consequently, about the accountability, representativeness and legitimacy of actors included in joint knowledge production for water governance” require special attention.

Finally, in a recent work Chambers et al. (2021) propose a framework for designing and assessing knowledge co-production processes. The authors analyse 32 empirical cases ranging different spatial (local to global) and temporal scales (from 18 months to 20 years) along four categorical variables to delineate six practical modes of doing co-production depending on: why actors coproduce (purpose); the way they conceptualise agency (power); how they tackle power relations (politics) and the manner in which they catalyse impacts (pathways). They further discuss the opportunities and risks of adopting each mode together with their expected outcomes and socio-ecological impacts. This framework offers a useful heuristics for addressing relevant design questions, anticipate dilemmas and potential tensions. In a later sequel, Chambers et al. (2022) expand their analytical efforts to explore the different avenues through which knowledge co-production can engender transformative impacts by a) elevating marginalized agendas; (2) questioning dominant agendas; (3) navigating conflicting agendas; or (4) exploring diverse agendas. Their insights point to not taking transformation for granted and strive to embedding co-production within wider processes of change. In the rest of the section, we draw on empirical insights from the literature as well as on our own experiences to discuss some of the most important barriers to actors’ knowledge mobilization in research processes.

## b) Challenges and constraints to knowledge co-production

The engagement of actors in research processes is anything but an easy and smooth process. Quite to the contrary, as the asymmetries in power and the difference in values and world views mentioned above suggest, it is not only costly but also brings tensions and challenges that need careful consideration before initiating a co-production journey:

- **Resources:** a defining characteristic of participatory processes is that they require time and resources. It is commonly argued that the longer the co-production process, the more effective they are in producing desired outcomes such as learning, trust, fruitful relationships, usable knowledge or sound policy outcomes (Walker et al. 2004; Ballester 2017). This is often

at odds with the strict time frame of research projects that rarely goes beyond 4 years. Time needs to be translated into adequate funding for covering the required working hours, but also other material and knowledge resources. Transdisciplinary environmental projects often concentrate more effort on quantitative modelling and ‘hard science’ activities than in the processes of engagement (Saito 2020). This unbalance can turn into meaningless (not useful for the knowledge production process) or ineffective (not producing desired outcomes) actor mobilization.

- **Expertise and experience** with participation are also capacities to be considered when designing, implementing or getting involved in knowledge co-production processes. Some studies highlight the pressure and even anxiety that researchers may feel when facilitating participatory open-ended processes (Dembek et al. 2020). Therefore, it is pertinent to raise questions about the skills, training and support required by researchers at the onset of the process. Alternatively, researchers might opt for participating in ongoing co-production processes in their case studies, or observing those processes as study objects.
- **Planning:** whereas planning for co-production moments and formats along research processes is fundamental, things usually do not work out as planned in participation. The engagement of actors may introduce unforeseen aspects in the research process and divert the original planning to new goals and questions. To some extent, these aspects can be anticipated when designing research processes by introducing mechanisms for flexibility. However, it is important to maintain an ethics of care (Temper et al. 2019) to what a researcher can accomplish in a 3-4 years PhD project.
- **Recruitment:** one of the most challenging steps in a co-production process is the initial mobilization of actors. Achieving a representative sample of actors willing to take part in knowledge co-production activities can be a daunting task. The design of representation rules in terms of who is entitled to participate and how is a delicate step. Moreover the practical matters of how to approach people (how to find them, how to contact and establish communication) are also important. The term ‘stakeholder fatigue’ refers to actors’ negative perception of their role in participatory venues or of being called to participate. It is common to find a lack of response or interest in the purposes and expected outcomes of knowledge co-production processes. Rejections and last minute cancelations are not rare either, especially when participants are policy actors (Guimarães Pereira et al 2020).
- **Tensions between academic and non-academic actors:** producing social and environmentally transformative knowledge might not always lead to cutting edge publications in Q1 journals. There can be tensions between what is valued and rewarded in the global academic system and what is useful to people you want to engage with. There are also divergences in the questions researchers and non-academic engaged actors might find of interest or relevant to investigate, the methodologies to use and their timeframe (see the ‘critical comrade’ description in Temper et al. 2019). For this reason, the negotiation of shared goals for knowledge co-production is another difficult step that might take years (Norström et al. 2020). What type of knowledge, with whom and for what purpose are key questions to consider.
- **Positionality of researchers:** researchers are actors. We cannot be invisible, good-willing and all-overseeing facilitators. We are power/culture/interest (class, gender, age ...) driven actors

steering the knowledge co-production process. It is crucial to acknowledge our position as a person, as researcher and as any other role through which we act, understanding what values guide our work, what assumptions we bring and how they determine our choices and research design. As mentioned above, the *Tarot for transgressive research* from Temper et al. (2019) is a useful tool to guide researchers in their inner journey.

- **Tensions between different actors** with conflicting and competing interests. A participatory venue can become something close to navigating chaos if divergences and conflict emerge. Whereas creating spaces for addressing differences and tensions is desirable from a co-production perspective (Brugnach and Ingram, 2012), it can also be stressful for researchers, especially when they act as facilitators. The higher the degree of conflict among engaged actors in a case study, the most likely you will find tensions in participatory spaces that will shape the outcomes of the process and therefore the research results. These aspects are to be carefully considered when designing boundary rules (whom to involve) and participatory methodologies (how).
- **Power asymmetries.** Power is one of the issues that receives more attention in the literature on participation in general and on co-production and water governance in particular. We could argue with Schipper et al. (2019) that power asymmetries in all their manifestations (such as agency, resources, knowledge, gender, sexual orientation, race, language or geography) are to be handled with care, both from structural and procedural standpoints, from the outset of co-production processes. Otherwise, one may end up reinforcing them or generating undesired outcomes (Turnhout et al. 2020). There is also a need to take into account the power-related cultural and social nuances of specific contexts - for instance the role of elders or women in the community - in order to design adequate participatory spaces. This importantly also relates to the position of young researchers and their institutes, the relational power web of all persons involved in the research.
- **Evaluation:** a common critique of co-production as a research approach is the difficulty in determining whether it has been successful in achieving its goals (Norström et al 2020). Given that many outcomes of co-production processes happen way beyond project time frames, and that they are difficult to trace and measure, it is hard to set 'success' indicators.

### 3. Methodological approach for co-production adaptation and learning

As part of WP7, NeWave has developed a multi-step methodology that aims to help ESRs reflect upon the potential use of co-production approaches in their research projects and support their efforts throughout the research process. The development of this methodological approach has accompanied the implementation of the NeWave project, which was heavily conditioned by the mobility restrictions resulting from the COVID-19 pandemic:

- NeWave was launched in January 2020 and COVID-related travel restrictions started in March 2020.
- ESRs were incorporated into the project between July 2020 and January 2021
- Training schools were held online starting in November 2020.

- Most ESRs submitted their research proposals in the second half of 2021.
- Field work plans and collaboration activities with local actors and stakeholders were heavily impacted by COVID-related travel restrictions.
- PhD projects are scheduled to end by December 2023.

The methodological approach had to adapt to the evolving needs and goals of ESR projects and to the necessary mobility restrictions imposed by the COVID pandemic. It consists of six steps that are described below.

- a) Establish the theoretical foundation for knowledge co-production in the context of PhD research projects in water governance
- b) Encourage reflexive analysis on whether and how to incorporate a co-production perspective in PhD research projects
- c) Develop practical guidelines for co-production in PhD research projects: principles, questions and methods
- d) Working with partners in knowledge co-production
- e) Assessing and reflecting on progress and challenges
- f) Evaluating outcomes: Lessons learned on knowledge co-production in PhD research projects

### 3.1. Step 1: Establish the theoretical foundation for knowledge co-production in the context of PhD research projects in water governance

The first phase of the methodology has three primary goals: (a) provide a general theoretical overview and framework about co-production approaches in two interrelated water governance areas: research and science-policy interface for knowledge co-production in water governance; (b) conduct a preliminary assessment of participatory (knowledge co-production) approaches in ESR projects; and (c) help ESRs reflect upon the potential use of co-production approaches as a means of promoting actionability in the context of water governance research projects. In order to achieve these goals, we conducted several information gathering and discussion sessions in the initial phases of the project. These are detailed below.

#### **a) Development of a common conceptual framework for actionability, knowledge co-production and the interaction between science and policy in the NeWave project**

Between May and November 2020 the FNCA team facilitated an online discussion among NeWave supervisors based to:

- i. Discuss the theoretical framework for the development of the WP7 on actionability, transdisciplinarity and co-production.
- ii. Agree on a methodological approach to understand the participatory component envisaged in each ESR project; provide guidance, if needed, on how to integrate a participatory approach taking into account the aims and the context of each ESR; and include insights arising from the

conversations into a proposed guideline for participatory approaches, to ensure that deliverable D7.1 became a practical and useful tool to be used within NEWAVE by the ESRs.

Discussions revolved around some key concepts that informed the theoretical framework for actionability within NeWave – reflected in Deliverable 7.1 and summarized in section 2 of this report. These included:

- i. Conceptualizations or typologies of co-production which could be categorized in terms of the field of study (see section 2.2), depth of involvement (Saito, 2020), or the means and purpose of the knowledge co-production process.
- ii. Goals of the interaction with ESRs, which in accordance with the NeWave project proposal, were threefold:
  - Clarifying the underlying philosophy and ethics for co-production in the ESR projects
  - Appropriate level of engagement with stakeholders in the co-production process
  - Providing practical ideas about how to implement knowledge co-production tailored to project goals, limitations, barriers and expectations.

## b) Preliminary assessment of knowledge co-production approaches in ESR projects

A review of the ESR project descriptions included in NeWave's proposal was conducted in September 2020. This allowed us to identify those ESR research projects in which the definition or the research goals required the use of participatory or co-production methods (5 projects) and those where this approach was not required and thus where the potential role of co-production had to be discussed (10 projects). This initial review provided a basis from which to plan the initial training activities.

## c) Lecture on knowledge co-production and the science-policy interface in water governance lecture

As part of the [Water Governance Theoretical Perspectives](#) online training school that was organized by the NeWave project in lieu of the in-person first Training School planned for the fall of 2020, a lecture was delivered on **Knowledge co-production and the science-policy interface in water governance** on December 15, 2020. For more information see [here](#). The lecture served to introduce initial concepts on actionability, knowledge co-production and the interface between science and policy in water governance. The contents of the lecture were further developed in Deliverable 7.1 *Knowledge co-production in water governance* and have been included in this document.

## d) Initial survey and group discussion

A **survey** on co-production goals was distributed among ESRs in order to facilitate a **guided discussion** following the lecture. The survey was distributed before the discussion to help diagnose the starting point regarding co-production. The following questions were included:

- Is knowledge co-production a part of your research approach?

- What is the goal of using co-production approaches in your research project?
  - Improve the effectiveness of public policies through improving the use of scientific knowledge in public policies
  - Improve (academic) knowledge
  - Democratic legitimization of policy decision-making
  - Empowering local actors in their work to transform their environment
  - Social learning
  - There is no positive outcome, it limits research freedom
  - Others: \_\_\_\_\_
- What tools and techniques are you considering in the development of your co-production approaches?

Fourteen (out of 15) ESRs responded. Initial results indicated that:

- Co-production was clearly part of the research plan for 8 out of 14 ESRs (thus more than originally identified in initial project descriptions), 4 were open to introducing co-production at some point in the research process, and 2 were unsure.
- ESRs identified different goals for using co-production approaches in their research projects:
  - Empower local actors in their work to transform their environment (5)
  - Improve public policies / public service provision (5)
  - Improve (academic) knowledge (3)
  - Improve social learning (1)
- In a preliminary phase, they identified the following techniques to use in the development of the co-production approaches:
  - Interviews
  - Focus group discussions
  - Participatory models or actor mapping tools.
  - Participatory action research
  - Participatory process mapping
  - Participatory modelling
  - Collaboration with services providers (data sharing)
  - Workshops between scientists/producers of knowledge and knowledge users/practitioners.
  - Integration of local collectives into the policy analysis
  - Dissemination activities

The 45 minutes discussion following the lecture was organized in small groups with a follow up plenary and served to clarify doubts and exchange ideas on knowledge co-production goals, existing limitations, research design and potential techniques and tools.

### 3.2. Step II: Encourage reflexive analysis on the use of knowledge co-production in water governance PhD research projects

Discussion sessions on knowledge co-production were organized in three sessions in February 2021. The goal of these sessions was to encourage ESRs to reflexively consider the goals, values, expected

outputs and ethical implications of using this approach in research. Discussion groups were organized according to the goals for using co-production approaches that were identified in Phase I. Specifically they were grouped according to the three goals they identified for using co-production approaches in their research projects:

- Empower local actors in their work to transform their environment
- Improve academic knowledge
- Improve public policies / public sector provision

ESRs were asked to prepare brief presentations answering the following questions:

- i. What is the goal of using knowledge co-production approaches in your research?
- ii. Why are you personally interested in pursuing such a goal? What values drive your research?
- iii. What type of knowledge and/or other outputs are you trying to elicit /obtain?
- iv. With whom? Barriers to engagement?
- v. How? What methods?

ESRs were enthusiastic with the concept and ideas around co-production and see themselves as engaged scholars who want to impact the hydrosocial contexts in which their research take place. However, as individual researchers, they face many of the barriers described in section 2.2.b of this report regarding available resources, expertise, timing and engagement of stakeholders, power imbalances, conflicts and others. They struggle to balance their research goals and their desire for learning new approaches and engaging with people with the restrictions that derive from the boundaries of a PhD research project.

We observe a diversity of approaches to co-production that reflect the different scholar traditions as described by Miller and Wyborn (2018). Whereas many ESRs planned to include some sort of participatory methods and direct engagement of actors in knowledge production, others use co-production as an analytical lens to explore the interactions between science and policy, or to examine collective action in the delivery of water services. We therefore think there is opportunity within NEWAVE to think transversally and build bridges among different understandings of co-production, which thus far have evolved separately in the water governance literature (Lepenies et al. 2019). Furthermore, many ESRs resonated with STS ideas on co-production, a tradition that is underrepresented within this field. In addition to (sometimes mirroring) these conceptual nuances, we detected three types of approximations to co-production processes:

- Observation of a co-production process, having co-production as an analytical object. For instance the co-production of science and water policies in the case of the Water Framework Directive (STS co-production).
- Getting involved in an on-going co-production process.
- Promote a co-production process or a co-production moment.

Most of the ESRs did not consider knowledge co-production having a central role in their research. Only one planned for a full co-production process from the very beginning, with many still thinking how to include some participatory 'moments', and some even whether they should co-produce knowledge at all.

The line between qualitative research and co-production is fine and difficult to draw. Most ESRs plan to use participant observation, interviews or focus groups, which are traditional qualitative methods that have a participatory component. So, what is the difference? For the authors of this deliverable, knowledge co-production implies some sort of feedback to the participants, it cannot be purely extractive. They have to gain something out of their involvement: new information, learning, empowerment, new relationships, or other. Reward can have different forms, and even be very simple, but the idea of reciprocity is important and implicit in the coproduction process. A second feature characterizing coproduction and that is not usually considered in traditional qualitative methods, is the existence of some flexibility in the setting of the specific objectives, steps and means of the coproduction research, in order to accommodate the perspectives, interests and preferences of the non-academic actors participating in the process.

One idea that was repeated in a few research projects is that of interacting with actors with very different perspectives: local communities on one side, and policy processes, consultancy firms of water supply companies on the other side. While having different scales and trying to bridge them and generate feedback between them is extremely relevant in terms of co-production, it is also challenging and probably needs further reflection and careful planning.

Another challenge is that many of the ESRs view their research outputs as potentially actionable in policy or political processes. Yet, none had a specific plan on how to do that. It is important to pay some attention to this actionability goal from early stages of the research.

Some other key questions and dilemmas that emerged and we shall keep discussing with the ESRs throughout the NEWAVE are:

- How to initiate interactions with actors involved in environmental conflicts when you have a different position to those actors?
- How to be transparent and challenge the idea of impartiality, yet initiate a conversation?
- How to convey difficult messages/information, those that engaged actors might find controversial
- How to balance your research goals and demands from engaged actors? How to handle actors' expectations that I may not be able to address through my research?
- Is co-production necessary? Do researchers need to start thinking about it from the very beginning of research? Or shall I decide along the way whether I can and want to apply participatory methods at some point?
- If I apply qualitative participatory methods as a means to enhance the quality of the knowledge I produce without further engagement/commitment with participants, is that co-production?

### 3.3. Step III: Develop practical guidelines for ESRs on whether and how to incorporate a co-production perspective in PhD research projects

Building on steps I and II, practical guidelines were outlined to help early researchers wishing to carry out co-production research in water governance integrate these approaches early in research design process. These guidelines aimed to facilitate reflection on three key issues: research design principles; research design questions; and research methods for co-production.

#### a) Design principles

Building on lessons from an extensive sample of case studies, Norström et al. (2020) distil four general principles to guide co-production journeys, namely context-based, pluralistic, goal-oriented and interactive (Figure 1). We add two additional principles: power-sensitive and reflexive.

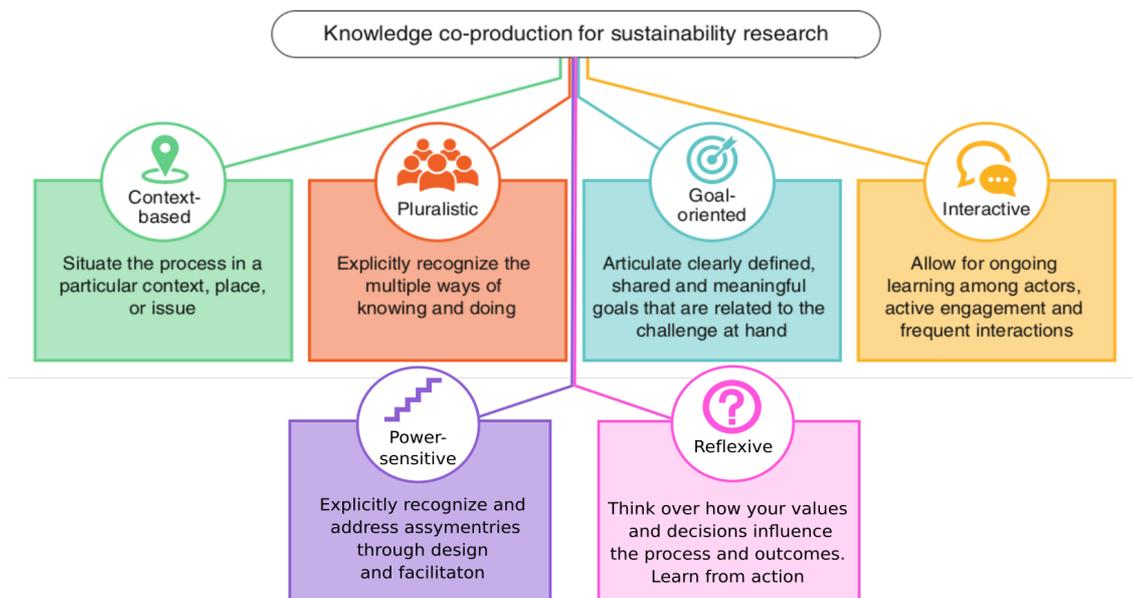


Figure 1. Principles for knowledge co-production. Adapted from Norström et al. (2020)

#### b) Design questions

When undertaking a research process and considering using a co-production approach, it is useful to reflect upon some fundamental questions to help evaluate its appropriateness, define its goals, and guide its design and implementation.

##### i. Why use co-production and to what end?

What is the goal of using knowledge co-production approaches in your research?

Why are you personally interested in pursuing such a goal? What values drive your research? What would bring to you and your research the interaction with actors?

- ii. **What?** What type of knowledge and/or other outputs are you trying to elicit / obtain?
- iii. **When?** At what stage of your research do you want to introduce co-production?
- iv. **With whom?**
  - Who are your partners in the co-production process? Whom do you need to involve given the answer to the two questions above?
  - What power asymmetries can you foresee among those actors? And among those actors and you as researcher?
  - What conflicts do you observe between those actors? And among those actors and you?
  - What barriers to engagement can you anticipate?
- v. **How?**
  - What methods / techniques are most useful to your specific goals?
  - What attitude is needed in a co-production process?

### c) Design methods

The answers to the previous questions will determine the research methods and techniques that are best suited to the research goals, context, partners and co-production approaches. Existing inventories and repositories of participatory techniques provide a plethora of information to explore existing alternatives and provide additional references and resources. Below we provide the links to two comprehensive and useful repositories:

[https://naturalsciences.ch/co-producing-knowledge-explained/methods/td-net\\_toolbox](https://naturalsciences.ch/co-producing-knowledge-explained/methods/td-net_toolbox)

<https://www.participatorymethods.org/>

Common stakeholder engagement strategies include workshops, town meetings, interviews, focus groups, surveys, and scenario work (Vincent et al., 2012; Mach et al., 2020; Frantzeskaki and Kabisch, 2016). Modes of engagement between researchers and stakeholders reflect different degrees of stakeholder interaction across research phases (Schneider and Buser, 2018).

Bremer et al. (2019) identify three phases of co-production:

- the *co-design* of the research;
- the *co-production* of science through conducting the research work; and
- the *co-dissemination* (and co-evaluation) of the results, noting that the level of stakeholder involvement can vary between phases.

If we consider co-production as a participatory process, or a process of engagement between researchers and stakeholders, it is useful to take into account what phases the process should have, and which are the goals, techniques and tools for each step. Figure 2 provides a useful example that can help guide the development of a co-production process.

**Steps in Quantitative Story-Telling**



**Methods applied and outputs obtained**

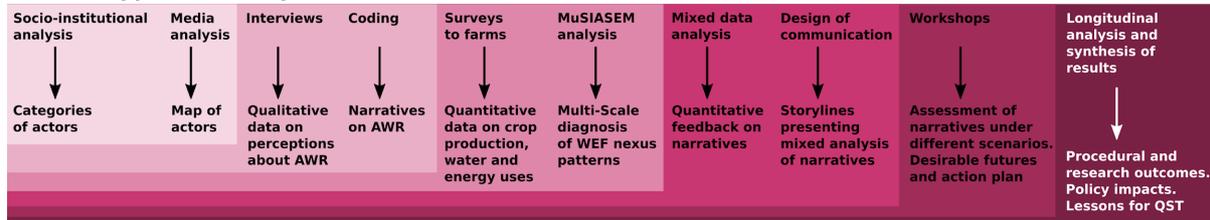


Figure 2. Overview of a knowledge co-production process case study. Arrows indicate the goal of each step, squares below show methods and outputs/outcomes obtained. Source: Cabello et al. 2021.

### 3.4. Step IV: Working with partners in knowledge co-production

One of the primary challenges identified by ESRs for the development and implementation of co-production of a PhD research project is the identification and engagement of partners for the co-production process. In order to assist the process and as part of the [NeWave Methodological training](#) we organized a session on working with partners in March 2021, at a time when ESRs were designing their research proposals. This step was co-designed with the ESRs who took an active role in giving shape to the NeWave Methodological training program. This Step consisted of three parts:

#### a) Survey on actor identification

Through a survey shared with ESRs before the online session, they were asked to identify potential partners in the co-production process. In order to encourage the ongoing reflexivity necessary for a successful co-creation process, ESRs were encouraged to reflect on their primary concerns and expected benefits regarding the relationships to be established throughout the process. The survey had the following questions:

- i. On a scale from 1-10, how familiar are you with your partner listed on the NEWAVE website?
- ii. Recognising that organisations are made of people, do you have a point person inside your partner organisation?
- iii. How does your listed partner approach research and is their technique something you are comfortable with?
- iv. Who does your advisor co-produce with and how?
- v. What are your most pressing concerns around co-production?
- vi. What do you see as the most beneficial part of co-production to your project?
- vii. Who do you think wants to work with you, attempt to identify people you could approach around collaboration?

Some of the primary concerns identified revolved around the following issues:

- The need to identify mutual benefits for all actors involved in the co-production process.
- How to ensure stakeholder engagement

- How to handle “uncomfortable knowledge”, polarization and conflict in a co-production process.
- What is feasible co-production, in terms of time and resources, in the context of a PhD project.
- How to create a safe process that is transparent, legitimate and accountable.

The main benefits identified could be group into two categories:

- i. Improved research process and knowledge generation
  - A wider contribution to knowledge, validation/triangulation of data, science dissemination and activism.
  - Incorporate different views and combine academic and practical knowledge.
  - Avoid extractive research and work on something with partners who deem the research questions and project worthwhile to their cause.
  - Engage with local partners in the research design to avoid bias and to push the development of theory.
    - Get feedback on research questions and research methodology, and ideally co-design these on the ground.
    - Integrate diverse perspectives and develop research useful for society.
- ii. On policy, management and social change (actionability)
  - Enable policy change
  - Thematised socioecological conflicts in order to identify possible solutions.
  - Improve the impact of research in a real world context.
  - Avoid doing an isolated research project that might be too detached from reality.
  - Use the research process and the findings to have a (small) impact.
  - Give voice to underrepresented expertise in the region and enhance the perspectives through this process.
  - Enable sustainable collaborations between other actors.

## b) Creation of actor constellations

ESRs were asked to reflect on the variety of actors involved at different stages of the research and co-production process, thinking about the way they related to one another, to the development of the research, and to the different outputs and outcomes. They were asked to develop “actor constellations” to reflect these relationships. Below are some examples of their contributions.

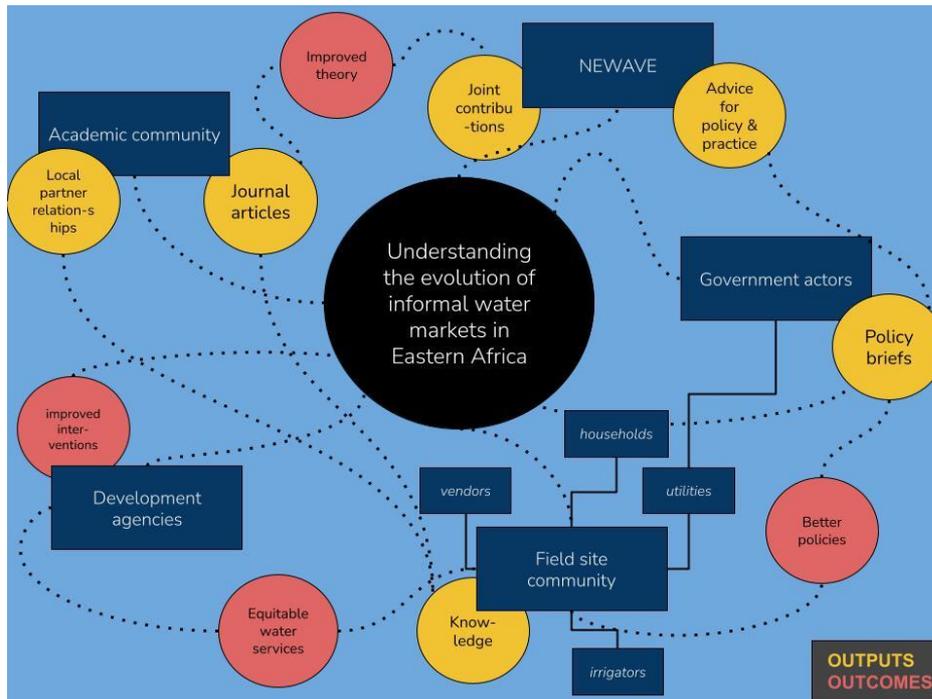


Figure 3: Actor constellation created by Gina Gilson

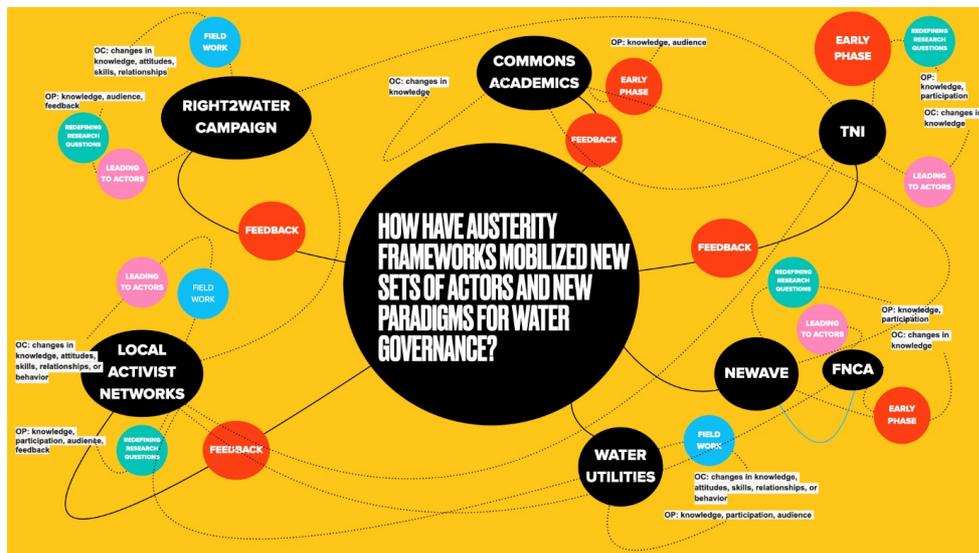


Figure 4. Actor constellation created by Dona Geagea

### c) Discussion seminar on working with partners

The seminar was an opportunity to reflect on some key questions that were posed by ESRs as a result of their work in the two previous steps (survey and actor constellation) through two panel presentations followed by small group discussions. Below is a summary of the questions and some of the insights offered by panellists and through the small group discussions.

- i. How to initiate interactions with actors involved in environmental conflicts when you have a different position from those actors? How to be transparent and challenge the idea of impartiality, yet initiate a conversation?

Some insights regarding these questions:

- **Different positions:** allowing diversity brings understanding and allows transformation.
- **Conflict:** life is relations, in relations we find conflict, and conflict brings change. Embrace it!
- **Awareness:** be aware of your belief systems, your ideas and positions, your rank (gender, race, economic status, age...)
- **Frame your context:** bring in more than thoughts and data.
- **Empathy:** try to put yourself in the place of other actors.

- ii. How to balance your research goals and the demands from engaged actors? What happens if they have expectations that cannot be met through the research?

Some insights regarding these questions:

- **Awareness:** be aware of goals and expectations.
- **Boundaries:** it is important to establish and communicate boundaries.
- **Relevance of the process:** too much focus on results limits freedom. Results are important but focus on the process.
- **Understand process as a continuum** things happened before and will continue to happen after the research. Relax!

- iii. How to manage the relationships between multiple co-producing / research partners?

Some insights regarding these questions:

- When thinking of partners, focus on the **people**. Institutions are not monolithic. Find partners in the people within the organizations.
- Understand the **roles** that individuals play within the organizations – enablers, gatekeepers, information providers.
- Informed **consent:** Communicate transparently with the partners what you are doing, why, and what the risks and potential benefits of participation are.
- Understand your goals and their motivation in participating in the research process. Avoid “extractive research”! Where is the **value proposition of the co-production process?**
- **Communicate clearly and regularly** with your partners throughout the process. Agree on a common work plan and expected outputs and outcomes.

### 3.5. Step V: Assessing and reflecting on progress and challenges

Implementing a co-production research project is necessarily an iterative and adaptive process that requires reassessing, reevaluating and revising goals, methods and tools through an ongoing reflexive process and in a dialogue with the co-production partners. In the case of PhD research project this

process of co-evaluation and reassessment is necessarily limited by the (temporal, financial and procedural) confines of academic requirements.

In order to support the ESRs co-production process we identified two points in time in which to encourage this reflexive process and help clarify questions and doubts. One had already taken place at the point this report was prepared (May-June 2022). The second one will take place in late 2022.

### **a) Mid-term assessment 1: May-June 2022**

In May 2022 the FNCA team shared a brief survey with ESRs inviting them if they would like to participate in an online seminar to discuss knowledge co-production approaches in their fieldwork. Ten out of 15 ESRs responded, with 8 of them expressing an interest in participating. The other two clarified that they were not using co-production in their research. They selected the following goals for the session:

- Discussing my research design in what pertains to co-production (4)
- Obtaining specific feedback or suggestions on co-production methods and tools (4)
- Obtain design suggestions for specific co-production activities (5)

Two 1.5 hour-long online seminars were organized in June 2022 in which a total of 7 ESRs participated. In preparation of the session, ESRs were asked to reflect on and share some thoughts beforehand on the following questions:

- What is or what would be your goal for applying co-production in your research?
- How do you/would you imagine the process of co-production in your research?
- What have you been able to implement so far regarding your co-production goals?
- How are you relating with the different actors in the identification of the research question(s) and methods?
- How have the research goals / questions and research methods evolved throughout the fieldwork process? What role have local actors played in this evolution?

### **b) Mid-term assessment 2: December 2022**

A second mid-term assessment will be organized in late 2022 or early 2023 with those ESRs that are using co-production as part of their research process or are interested in continuing reflecting on these issues. An initial survey will be shared asking them to identify specific needs and goals for the session. Online group discussion sessions will be organized with them and articulated around their expressed needs and interests.

### 3.6. Step VI: Evaluating outcomes: Lessons learned on actionability and knowledge co-production in PhD research projects

In the last trimester of 2023 we will organize a series of activities to assess the experiences and insights of ESRs in terms of actionability and co-production as part of their PhD projects. This process will help feed Deliverable 7.3 (see below).

These activities will include:

- Questionnaire / survey to gather preliminary insights (October 2023)
- Small group discussion sessions
- Final seminar with participation of ESRs and supervisors to discuss preliminary conclusions

## 4. Next steps

### 4.1. Academic paper

Preparation of a collaborative academic paper on the experience of using co-production approaches in the context of PhD research projects.

### 4.2. Deliverable 7.3. White paper on advanced participatory water governance

The Deliverable will propose a conceptual and methodological approach to tackle the challenges inherent to the management of complex hydrosocial territories (Boelens et al., 2016) that require the collaborative definition of problems, goals, alternatives and potential measures or solutions. The goal is to develop an approach that deals with the range of complexities of water-related challenges, taking the following elements into consideration:

- Identify different models of science (or research)-policy interface and the key components for an advanced participatory water governance
- Reflect on how to adapt the general framework for an advanced participatory water governance to different contexts
- Work from the outset with actors, social movements, and other interests in the case study regions or *problématiques*.
- Explore methodologies for transitioning from the co-production of knowledge to the coproduction of policies and lines of actions, by integrating the actors in the definition of the problems to be addressed, the goals to be achieved regarding such problems, the research questions, the required tools and how research findings and emerging lessons should feed the deliberative processes to define actions and decisions. At each stage of the process, the specific role of actors and how their inputs should be integrated, will be defined.

- Integrate data, qualitative information, model results and prospective analysis from different (and often conflicting) scales, disciplines and dimensions, in order to produce diagnosis and prospective analysis as Best Available Knowledge (BAK) to inform action and decisions. Specific tools will be explored to optimize how this BAK can be generated and used in decision processes.
- Consider the role of technological innovation and new resources, as well as the social innovation required for advanced water governance.
- Analyze the historical/cultural dimension, dominant discourses, socioeconomic elements and power relations, taking into account conflicts and tensions in contexts of diverse and changing environments.

At the level of the methodological approaches some of the research questions to be addressed are:

1. Which methodological approaches can be used to operationalize interdisciplinary and participatory approaches to generate co-produced knowledge and co-produced policies and lines of actions? How can the Best Available Knowledge be used to inform actions and decisions?
2. How can we combine general methodological frameworks with problem-based approaches to address real issues from an actionable knowledge perspective? Is it possible to draw a roadmap tackling the trade-offs between general methodological approaches and specific requirements of concrete problems?
3. What are the biggest roadblocks to translate research developed using participatory-transdisciplinary approaches into actionable outcomes in the field of water governance? How can participatory-transdisciplinary approaches generate actionable knowledge?
4. What are the implications, difficulties and challenges associated with engaging citizens and interest groups in water resources research and water governance? What opportunities emerge from the active implication of different actors in the co-production of knowledge and policies or lines of actions? What type of social innovation is required as condition for advanced water governance models?

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