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An analytical framework for examining communities of practice in water management: a reflection on what they do and contribute to?

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Communities of practice (CoPs) have become a new water resource management paradigm. CoPs are highly regarded for promoting peer-to-peer knowledge sharing and collaboration, leading to better water management decisions and actions. Yet, the mechanisms through which CoPs operate, including what kind of learning is being pursued, for what, how, and by whom, are, however, often black-boxed. This research develops an analytical framework to understand better what water-related CoPs do and contribute to. The framework was co-developed, drawing from the experience of over 50 CoPs experts in water and environmental management. A series of preliminary discussions were held to identify existing frameworks that were then used to develop a draft skeleton of the analytical model. The framework was then tested and refined through interviews before being validated in a collaborative workshop. This paper details the developed three-block analytical framework—(i) context; (ii) processes (iii) outcomes—and uses examples from consulted water-related communities to illustrate its schematic components. Ultimately, this research aims to assist CoP coordinators in making more informed decisions about the design and maintenance of their water-related CoPs.

Keywords: communities of practice; analytical framework; social learning; water resources management

1. Introduction

As the number of communities of practice (CoPs) in water management has recently skyrocketed, evidence seems to suggest that communities have become a new tool for many of the international organizations involved in water management. While they were typically established to promote knowledge sharing and peer learning (Page & Dilling, 2019), communities have been deployed to address an increasingly complex range of water governance challenges (Edelenbos & van Buuren, 2006). They are promoted to advance policy change, reduce conflicts, boost inter-organizational coordination, overcome sectoral

and intercultural barriers, promote technology diffusion and innovation, and empower local voices and initiatives (Camacho, 2009; Cundill et al., 2015; de Groot et al., 2022). Although CoPs offer significant benefits, Vincent et al. (2018) caution against viewing them as a panacea for every challenge in water governance.

Beyond scoping the limits of what they can and cannot accomplish, there is also a need to critically reflect on how CoPs are designed and operate in the water domain (Fulgenzi et al., 2020). Existing frameworks on CoPs typically provide step-by-step guidance on establishing and maintaining community engagement (e.g., Catana et al., 2021; Eisenberg, 2018; Webber, 2016). However, only some are intended to understand their functioning in the context of water management, and even fewer offer insights into identifying the specific water governance advances they can bring. Consequently, those who design and maintain water-related CoPs often lack a clear analytical understanding of whether they are effectively set up to achieve their intended learning and governance change outcomes.

Drawing from contemporary social learning theories (Illeris, 2018), this research develops an empirically grounded analytical framework to examine the structuring characteristics of water CoPs. The framework provides a typology to discuss in further detail the various design and operational features that characterize the learning processes and outcomes associated with water CoPs. Ultimately, this framework aspires to become a tool for leaders and coordinators to reflect on their CoP design choices and guide them in making better informed and adapted decisions regarding establishing and maintaining their communities. This includes what kind of learning is needed, which aspects of experiential learning should be prioritized, who gets invited, how open the community is to newcomers, and how to monitor and evaluate the value(s) that a CoP generates.

Aligned with the generational framework of Knowledge Management for Sustainable Development (KM4SD) (Boyes et al, 2023), this paper underscores the need for a transition towards an integrative and systems-oriented approach to knowledge sharing and application (Cummings et al., 2019). The participatory design and development of this analytical framework reflects a commitment to co-creation, multi-stakeholder processes, and new knowledge partnerships, hallmarks of the KM4SD generational framework. Additionally, the focus on capturing and evaluating the tangible outcomes of CoPs from a bottom-up perspective, resonates with KM4SD's emphasis on identifying alternative discourses to how knowledge is being produced and used (Boyes et al., 2023).

This paper has five sections. Section 2 introduces the concept of CoPs and provides an overview of their presence in the water sector. Section 3 lays out the research objectives and the three-step methodology employed by this research. Section 4 presents the results and a detailed explanation of the framework, along with practical examples demonstrating how its various components can be applied to explain the range of design choices available to CoP

managers. Lastly, Section 5 explores the broader implications of this framework and suggests ways that CoP coordinators can use it as a checklist to guide their efforts. We conclude by examining the framework's limitations and outlining potential directions for future research.

2. Communities of practice in water management

The term 'community of practice' was coined by Jean Lave and Etienne Wenger (1991) to describe the social learning processes associated to situated working environments. The term was later refined by Wenger and is now commonly defined as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger-Trayner et al., 2023: 11). To distinguish CoPs from other collaborative groups and networks, such as multi-stakeholder platforms, living labs or task forces, Wenger (1999, 2011) developed a three-dimensional definition of CoPs (Figure 1), which has become the benchmark reference to determine whether a social group or network qualifies as a bona fide CoP (Mercieca, 2017; Sethi, 2017).

In the past two decades, international organizations involved in water management started realizing the potential of CoPs. They thus began establishing numerous communities to accelerate their work on specific water-related issues. Notable examples include the WMO CoP for Flood Forecasting and Warning[1]; the World Bank Water Communities,[2] and the Water and Open Government CoP[3] founded by SIWI, WRI, WIN, and Fundacion Avina. Additionally, GWP supports over 20 CoPs on various water management topics, such as transboundary water cooperation, gender and social inclusion, and SDG 6.5.1. implementation[4]. Besides, there are several networks and professional groups, albeit not formally called a 'Community of Practice' (e.g., the UNCCD Communities of Learning and Practice (CLPs)[5] or IWA's specialist groups[6]) that fit Wenger's analytical conceptualization for CoPs. Annex 1 presents selected examples from CoPs that were consulted in developing this analytical framework, which also gives a sense of the diversity of CoPs currently operating in the water space.

Academically, studies on CoPs have been conducted in almost every sub-sector of water management, e.g., in the WEFE (water-energy-food-ecosystems) Nexus (Mochizuki et al., 2021; Mohtar & Lawford, 2016; Smith et al., 2017) drought and climate variability adaptation (Dilling et al., 2022; Grainger et al., 2021; Kalafatis et al., 2015) and water service provision (Camacho, 2009; Carden et al., 2016). Given that the concept of CoPs originated from learning and educational sciences, a major research focus has been directed towards highlighting the contribution of CoPs in promoting peer-to-peer knowledge sharing and enhancing capacities among water professionals and decision makers (Attwater & Derry, 2005; Fulgenzi et al., 2020; Tran et al., 2018). Apart from bolstering knowledge and technical skills, researchers have also suggested that water-related CoPs can help bridge science and

policy (Iyalomhe et al., 2013) and foster cross-sectoral cooperation (Page & Dilling, 2019). Furthermore, CoPs can presumably trigger change at different scales; from transforming local water management practices (Joshi & Bhardwaj, 2015) and contributing to the development of national policy frameworks (Foster et al., 2019) to promoting the adoption of transboundary agreements (Timmerman et al., 2023).

Figure 1. Dimensions of CoPs (Source: Adapted from Wenger-Trayner et al. (2023)).

Since the literature on CoPs in the field of water management is more conceptual than empirically grounded, there is however a tendency to short-circuit the causal relationship between "what CoPs do?" (e.g., workshops, co-production of tools, prototyping) with "what do those activities produce?" (e.g., enhanced knowledge, trust building, new practices). This is gradually leading to the hyperinflation of the CoPs, which are now increasingly portrayed as a new one-size-fits-all solution for addressing water challenges (Vincent et al., 2018). As such, there is a need to analyze social learning processes further and identify practical measures to assess the contribution of CoPs in promoting social learning and sustainable water management.

3. Research objectives and methodology

The objective of this research is to develop an empirically grounded analytical model that can be used to carefully unpack the functioning and contributions of CoPs in water management. This framework aims to serve as an investigative tool to explore why social learning has

happened (and where it has not). In that sense, it can be used to understand the qualities of a CoP but also to identify its challenges and where community facilitators might get typically stuck. The framework was designed to respond to a series of key interrogations that CoP leaders and facilitators ask themselves while establishing and maintaining their water-related communities, including, but not limiting themselves to: In what way does the hydrological and social environment influence a CoP's learning agenda? What kind of knowledge is being pursued, how, and by/with whom? And what can we say about the possible contribution of CoPs to advancing water governance change?

To develop this analytical framework, we employed a three-step participatory process. The first step involved conducting a desktop literature review and engaging in discussions with water professionals and CoP experts to identify major frameworks addressing social learning in water management. We began by examining a wide range of learning models from the adaptive governance literature (e.g., Folke et al., 2005; Foxon et al., 2009; Berkes, 2017; Pahl-Wostl et. al., 2007a) and refined our selection based on insights from our discussions with experts. A key distinction emerged between frameworks that place social learning processes at the core of their conceptual model and those that treat learning as one of many processes underpinning socio-ecological system transformations. With this distinction in mind, we prioritized frameworks emphasizing "learning together how to do things better together" over those focused on "learning to adapt".

To identify a foundational working model, we organized a workshop session at Stockholm Water Week 2023 titled "Accelerating Governance Change through Social Innovation and Communities of Practice." This session brought together 52 water experts, many of whom worked on issues related to knowledge management, professional education, and capacity building. Through the workshop, we identified Bouwen and Taillieu's (2004) framework, "Multi-Party Collaboration for Social Learning in Natural Resources Management," as the most valuable conceptual roadmap for understanding how CoPs function and generate outcomes in the context of water management. On the one hand, roundtables discussions revealed that Bouwen and Taillieu's framework was found to be conceptually compelling for its clean three-block structural view on social learning, breaking it down to the context, process, and outcomes. On the other hand, however, the framework was shown to be lacking from two perspectives: first, for black boxing the social learning process as the use of 'facilitating mechanisms' applied to 'collaborative problem/task management' and; second, for reducing the outcomes to 'technical' and 'relational' qualities, thus disregarding other potential effects of a CoP, for instance, on policy or cognitive change.

As a second step, a draft of an improved analytical framework was developed before being tested and refined through a series of online interviews with 33 participants between March and June 2024 (Annex 2). Interviewed experts were identified via professional networks, a web search for water-related CoPs and then also through snowball referral, a proven method

used for selecting practitioner interviewees (Parker et al., 2019). In terms of stakeholder type, 'intergovernmental organizations' were the most represented group with 13 representatives, followed in order by stakeholder representatives from 'university/research institutes' (7), 'private sector' (5), 'international organizations' (5) and 'governmental organizations' (4). Together, the interviewed experts represent the experience of over 30 CoPs in the water space. These CoPs are from various sub-sectors (e.g. transboundary management, nature-based solutions (NbS), disaster management, etc.) and operate in different regions and geographical scales (national, regional, and global), thus offering a representative sample of CoPs working in the field of water management.

Informed verbal consent was obtained from study participants prior to their participation. Interviews were transcribed using the Microsoft Teams Record and Transcription software. Transcripts were compared and checked against interview notes for correcting language inconsistencies and filling in minor grammatical gaps.

The interviews began with a general presentation of the framework followed by a discussion based on several open-ended questions to elicit reflection, drawing from the experience of the communities these experts were engaged with. This allowed us to test the analytical capacities of the framework by using each analytical block to reflect on how their CoPs are being organized and managed. It also allowed us to fact-check whether the analytical framework responded to the original objectives that motivated its creation. At the same time, these interviews allowed for drawing a rapid landscape assessment and identifying some dominant trends of CoPs in the water domain, e.g., in terms of the participatory approach adopted or preferred learning orientations, etc. Interview findings were cross-checked and triangulated with community or project documentation (e.g., CoP webpages and annual activity reports).

In the third step, the framework was validated through a participatory online workshop with 33 water professionals and CoP experts, 21 of whom had not participated in the interview consultations. A series of propositions were submitted for group discussion, including: does the framework (i) explain how the context can influence communities, (ii) allow to unpack the learning processes of CoPs, (iii) help clarify what are the specific kinds of contributions that CoPs can bring towards advancing sustainable water management? Workshop moderators synthesized the results of the group discussions. An online follow-up debriefing session was organized to discuss possible cross-references made under each schematic element of the framework and to validate findings.

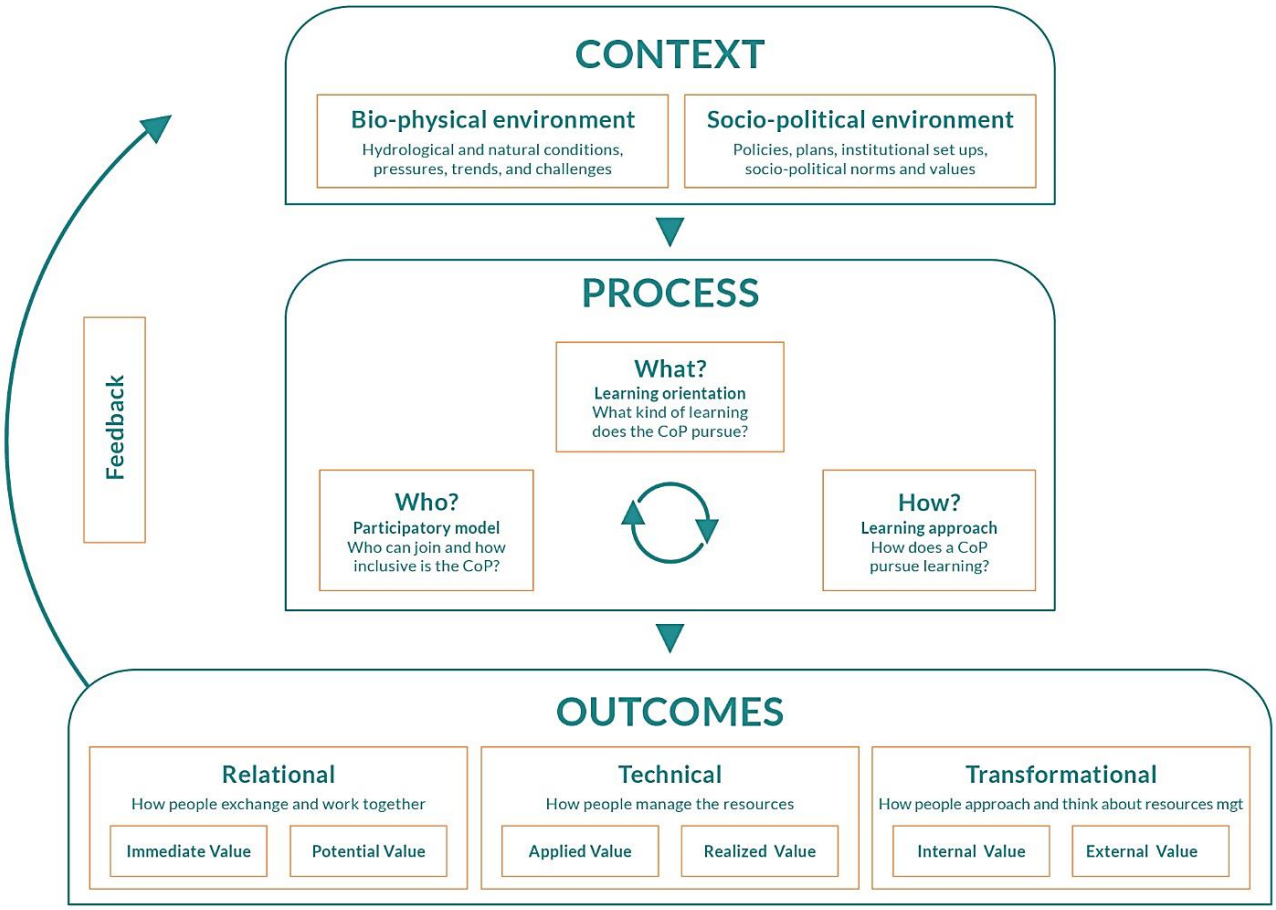

Figure 2. A Conceptual Framework on CoPs and Social Learning in Water Resources Management.

4. Results: a consolidated analytical framework

4.1. Organizational structure

The framework is built on Bouwen and Taillieu's (2004) cyclical model of multi-party collaboration and social learning for natural resources management, a widely applied framework used in environmental and water governance (see, e.g., (Mostert et al., 2007; Pahl-Wostl et al., 2007b; Pahl-Wostl & Hare, 2004; Tippett et al., 2005). Following Bouwen and Taillieu's original conceptualization, the framework proposed here is framed around a three-block skeleton of social learning: (i) context, (ii) process, and (iii) outcomes, which are interconnected by an iterative feedback loop (Figure 2). Since Bouwen and Taillieu's framework was noted to lack precision regarding the learning "processes" and "outcomes", we additionally incorporated four other known concepts and models from participatory environmental governance and social learning theory. Concerning the learning processes, we incorporated concepts from the learning loop model (Argyris, 1977, 2004; Argyris & Schon, 1992), experiential learning (Kolb, 1981, 2014), and legitimate peripheral participation (Lave & Wenger, 2001). The categorization of the learning outcomes in the framework presented

here is built on the Value Creation Framework (VCF) (Wenger-Trayner et al., 2020; Wenger et al., 2011). The following is a detailed description of the three main schematic blocks of the framework and the interactions between each of those elements.

4.2. The context: how does the bio-physical and socio-political environment influence the CoP?

Social learning takes place within a context, and as Wenger argues: "communities of practice cannot be considered in isolation from the rest of the world or understood independently of other practices" (1999: 103). Following Bouwen and Taillieu's (2004) original model, our framework highlights the importance of beginning to unpack how a community operates by first looking into how it is influenced by the "bio-physical" and "socio-political" environment. These two contextual elements are embedded within the social learning processes, meaning that they will affect but also be affected by the learning dynamics and outcomes that CoPs generate (Pahl-Wostl et al., 2008).

As human and hydrological systems are inextricably coupled, the bio-physical conditions can have a considerable influence on people's perceptions and behaviours (Garcia et al., 2016). The state of the bio-physical environment can influence social learning by shaping what people think is a priority area that requires collective learning action. To give a simple illustration of this, a CoP dedicated to irrigation efficiency is unlikely to get traction in a country or region where freshwater is abundant–and vice versa insofar as water scarcity may push people to want to engage in a CoP dedicated to enhancing irrigation practices. As such, bio-physical conditions can be used as what Mostert et al. (2008) call "framing and reframing" processes, which can then play a significant role in setting the stage for the learning agenda pursued by a CoP. This includes areas within a 'domain' where learning is seen as important to pursue and where it is not.

Several interviewed community representatives noted a significant impact from the bio-physical context and hydrological conditions on their CoPs, particularly how disasters and hydro-climatic extremes events act as catalysts. Both the NbS in Water Management CoP[7] and the Central Asian CoP on the WEFE Nexus[8], for instance, saw a dramatic surge in the attendance of webinars, number of people applying to join the community, and in the online interactions as a result of the Slovenia floods of August 2023[9] (personal communication, participant 1, 22/03/2024) and in Kazakhstan in May 2024 (personal communication, participant 27, 06/05/2024). Similarly, the Technical Committee on Ice Research and Engineering[10] is becoming one of the most active IWHR communities[11], which is likely driven by the increasing awareness of glacier melt brought forth by recent glacial lake outburst flood events and images of receding icebergs (personal communication, participant 17, 19/04/2024).

The social-political environment plays an equally important role in shaping the social learning process in environmental management (Keen et al., 2012; Pietz & Zeisler-Vralsted, 2021), and thus, in how a CoP works. CoPs that operate in domains where "societal-wide learning processes" (Bawden et al., 2007) are dynamic benefits from being able to tap existing social networks. This is true for communities such as the UNCCD CLP and the IDMP CoP[12], which can mobilize vast existing networks of researchers, community-based organisations, and governmental authorities already engaged in national and international forums such as the UNCCD Conference of Parties or the Drought Resilience +10 Conference. Moreover, as Bicchi (2022) argues that CoPs can use the policy frameworks to anchor their practice and legitimize their existence. The WEFE4MED[13] and the BONEX[14] Communities, for instance, benefit, from one side, from the EU's funding commitment towards supporting the implementation of the WEFE Nexus in the Mediterranean through the PRIMA programme (European Commission, 2024), and on the other, from UFM Water Policy Framework, which has a significant WEFE Nexus component (UfM, 2019). In theory, the absence of a policy framework–or one that runs contrary to the CoP's practice–could also inhibit the development of the community. Yet, none of the consulted CoPs representatives have shared examples where the social-politico environment played against them.

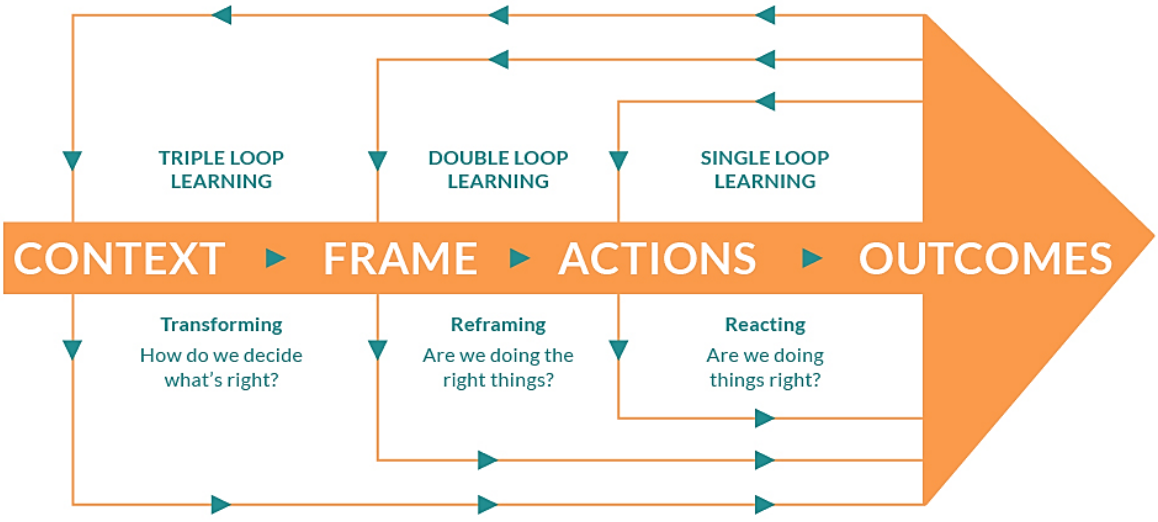

Figure 3. Learning Loop Model (Source: Adapted from Tamarack Institute (2017)).

4.3. The processes: learning about what, how, and with whom?

4.3.1. Learning orientation: what kind of learning does the CoP pursue?

The learning loop model can serve as a valuable framework for characterizing the different type(s) of learning that a CoP may wish to pursue (Argyris & Schon, 1992). We propose that a CoPs' learning orientation falls within three broad categories: "are we doing things right?" (single loop); "are we doing the right things?" (double loop); "how do we decide what's

right?" (triple loop learning) (Figure 3). While noting the differences between the three types of learning, multi- or triple-loop learning should not be considered superior to double or single-loop learning; they represent different learning orientations. The type of learning that a CoP wishes to pursue depends on the size of the community, the needs of the members, and relations among them, but also on the characteristics of the broader learning environment, i.a., the level of knowledge maturity of the domain and the nature of the CoPs working practice (Fuller et al., 2005).

As communities in water management often form around specific concrete technical and informational problems (Page & Dilling, 2019), unsurprisingly most of the consulted CoPs were predominantly geared towards single-loop learning. More than half of the CoPs leaders consulted built their community to serve as a 'help desk', where members can come with their problems and get tangible advice from their peers. In this light, one of the CoP coordinators argued that what "people crave is information that's actionable information and practical information that they can use to change the way they do business" (participant 10, personal communication 16/04/2024). Another consulted CoP expert also presented their community as one guided by a troubleshooting mandate focusing on "the application of the learning in the transformation of everyday work" (participant 30, 27/05/2024).

Besides, pursuing double and triple learning is only sometimes considered desirable or feasible. For instance, while the Global Water-Energy-Food (WEF) Nexus Community[15] aims to infuse double and triple-loop thinking in their training events and summer schools, their coordinators have also realized that focusing on more complicated and complex questions may lead to certain trade-offs: "often you find if you are too global or too transformational, you become too idealistic and lose relevance at the local level because you're a bit detached from the realities of things" (personal communication, participant 33, 11/06/2024). Similarly, another consulted community moderator shared that pursuing double or triple learning requires time and some level of trust between participants, which is something that is proven to be difficult, especially for virtual communities (Eggs, 2012). As a predominantly online community, the coordinators of this CoP were satisfied with the problem-fixing type of learning they have been able to pursue so far (personal communication, participant 1, 22/03/2024).

A smaller sub-set of communities have nevertheless been guided by an active pursuit of double and triple loop learning. In the WEFE4MED CoP, pre-launch community meetings focused on the unintended consequences of solar irrigation, which could be an example of double-loop learning. Many of the identified WEFE demonstrators look beyond the interconnection of the 'Water-Food-Energy-Ecosystems' Nexus and bring in other considerations, such as how the demonstrators link to topics of gender inequality or youth unemployment (WEFE4MED, 2024). The WEFE4MED community thus exemplifies a pursuit for triple-loop learning insofar as it is guided by a continued desire to be a space to

reflect on the usefulness and limitations of the current conceptualization of the WEFE Nexus approach and encourage its members to think beyond the 'WEFE-box'.

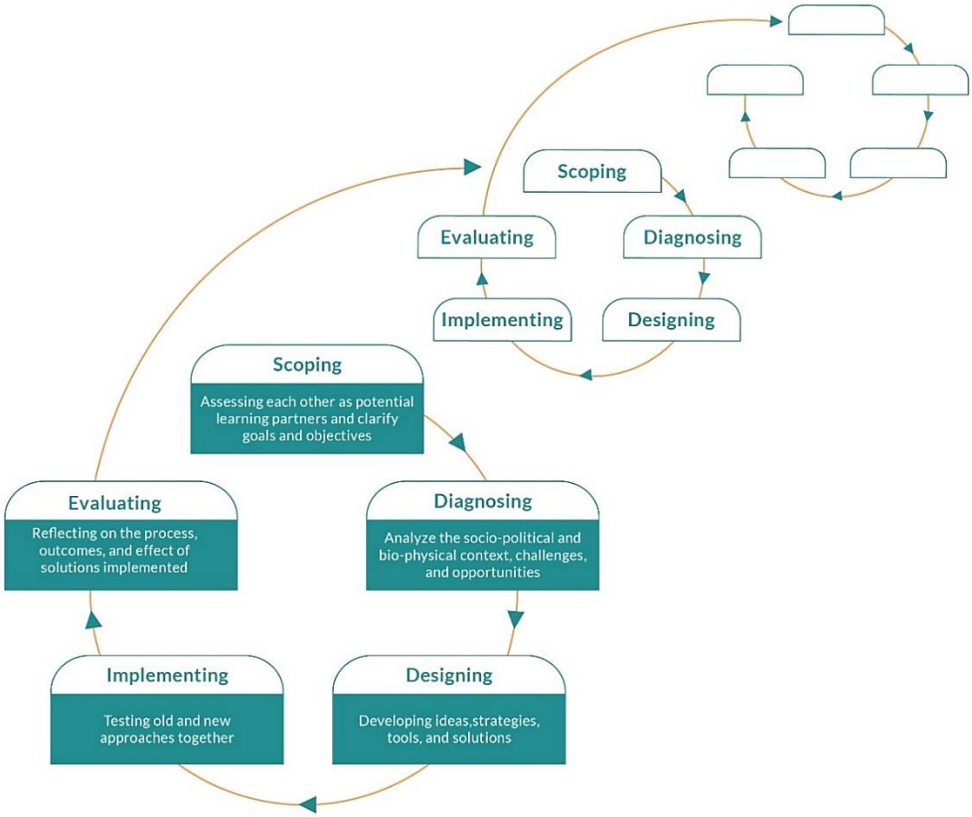

Figure 4. Experiential Learning in CoPs (Source: Adapted from Keen et al. (2012)).

4.3.2. Learning approach: how does a CoP pursue learning?

One way of examining how a CoP pursues learning is to assess how much effort and energy the community dedicates to each phase of the experiential learning cycle (Kolb, 1981, 2014). Using the Keen et al. (2012) expanded version of the experiential learning model as a reference (Figure 4), the cycle can be broken down into five elements or steps. To kick start the social learning process, CoPs often carry out (i) 'scoping' activities to offer potential members the chance to get to know each other and assess the degree to which they would constitute good potential learning partners for each other. Typically, scoping happens parallel to (ii) 'diagnosing', where members talk about "what keeps them up at night" and examine the various dimensions of their shared problem or the facets of the opportunity they'd like to explore jointly. Then comes a (iii) 'designing' phase, where members exchange possible solutions and develop ideas and strategies to overcome the issues they have identified. As the next step, CoPs can work on (iv) 'implementation' aspects, helping their members experiment with new ways of doing and putting their ideas into practice. Finally, CoPs are a space for (v) 'evaluation', allowing their members opportunities to reflect together on the

results of their newly employed solutions or revisited practices. CoPs tend to pursue experiential learning iteratively, using the learnings and momentum gained through one cycle to propel another (Kolb, 2014).

Depending on the community's learning orientation and needs, CoP managers can decide to spend more or less time on each phase or skip some phases. For instance, one could expect a community driven by single-loop learning to invest considerable efforts in 'diagnosing' and 'designing' together. In contrast, a CoP that aims for triple-loop learning may tend to favour activities focused on 'evaluating'. Most of the consulted communities dedicated more attention to the first three learning stands, partly by choice but mostly because of operational and budgetary constraints. More than three quarters of the consulted CoPs interacted mostly online with only occasional face-to-face engagements (e.g. UNCCD CLPs, IDMP CoP, World Bank Communities). As a result, they often decide to focus on 'scoping', 'diagnosing' and 'designing', and leave 'implementing' and 'evaluating' as something that members should do offline between community webinars or other online events. Also, even when there is face-to-face interaction, more than 80% of the consulted CoPs do not have field visits built into their programs, reducing prospects of seeing whether knowledge and tools gained (and hopefully applied) through the community create tangible change. At least half of the CoP managers consulted raised the importance of funding constraints as limiting their ability to do implementation/piloting and evaluation together.

The few communities that built their engagement around demonstration sites were better able to "close" the experiential learning loop and carry out activities that had a component of joint implementation and evaluation. One example is the BONEX community, which created a methodological tool called the WEFe Framework. This framework was iteratively developed and tested in seven carefully selected demonstration projects, representing a range of contexts, challenges, and technologies in the Mediterranean. The goal was to ensure that the results are genuinely replicable and account for the socio-ecological and cultural diversity of the Mediterranean region (BONEX, 2024). Another CoP that has a strong focus on the implementation and evaluation elements, is the WEFE4MED CoP, which has a twinning and mentoring program as well as study visits for demonstration site representatives to reflect together on the effects of their implemented WEFE pilot solutions (WEFE4MED, 2024).

4.3.3. Participatory model: who can join, and how inclusive is the CoP?

To fully unpack the learning process of a water CoP, one needs to additionally understand the membership model of a community and the degree to which it is welcoming to outsiders/newcomers. The community membership structure is guided by a set of formal and informal rules that regulate boundaries around "what does it take to qualify as a member?" and "how big should the community be?" (Wenger et al., 2002). Besides being dedicated to making a difference in shared areas of interest, CoP members can decide to restrict membership based on a certain list of eligibility criteria, such as coming from a specific

professional background, age, gender, geography, sector, institution, etc. (Wenger, 1999). For instance, some communities may require an organizational affiliation but also having reached a specific ranking in the management of that organization as a condition for membership eligibility (Ijjasz-Vasquez et al., 2024).

As for CoPs in general, there is no ideal membership structure or size for water-related communities. What matters is whether the number of members is consequent with the ambitions of the community and the difference it is trying to make (Wenger-Trayner & Wenger-Trayner, 2014). On the one hand, small communities foster close-knit relationships and deep engagement making it possible for members to know not only "who does what" but also "who knows what" (Wenger et al., 2002). The downside is that they may lack diverse viewpoints and be more limited in resources, something which can end up creating an 'echo chamber'. Some small communities also risk becoming overly exclusive, fostering a sense of elitism that can leave those outside the group feeling excluded or alienated (Gourlay, 2011). On the other hand, large communities can provide a wealth of knowledge and varied experiences. They are also typically better at creating connections with other communities and networks, thus promoting transdisciplinary thinking and approaches (Cundill et al., 2015). That said, large communities can risk becoming too generic, unwieldy to coordinate, and less personal.

The water-related communities that were consulted give a glimpse of the diversity regarding membership models in water CoPs. On the 'exclusive' end of the spectrum, there are small communities like AGUASAN[16], where members need to belong to a Swiss-based organization involved in water and development but cannot be from the private sector (participant 22, personal communication, 25.04.2024). Another example of a relatively small and exclusive community is the Armenian Drought Management Community[17], whose members primarily consist of experts from hydrometeorological and river basin authorities. Moreover, the online exchanges are conducted almost exclusively in Armenian, effectively limiting membership to Armenians (or at least Armenian speakers). At the other end of the spectrum, there are predominantly virtual CoPs open for anyone to join and have hundreds—if not thousands—of members, such as the NbS in Water Management, SDG IWRM, UNCCD, IWA, and SUSANA[18] communities. While specifying their target audience on the community registration page, these groups are technically open for anyone to join as long as the individual is willing to create an account on the CoP virtual platform. Somewhere in between are communities such as the Central Asian CoP on the WEFE Nexus, which require a separate application to be a member, whereby the applicant sends a note that is then screened by a moderator for background relevance before they decide to grant admission into the community formally[19].

Borrowing from the concept of legitimate peripheral participation (Lave & Wenger, 2001), it is also essential to consider the extent to which a community actively reaches beyond its

boundaries to engage and recruit individuals outside or on the periphery of its structures (Figure 5). Legitimate peripheral participation can take many forms, such as inviting newcomers to attend meetings to become familiar with key concepts or assigning straightforward tasks to introduce them to the community's practices (Campbell et al., 2009). CoPs in healthcare and education often utilize work-shadowing and mentoring programs as a means for newcomers to learn the ropes (Bottoms et al., 2020; Orsmond et al., 2022).

More than half of the consulted water-related community leaders have shared that they intentionally created opportunities for 'outsiders' and 'lurkers' to engage and become more active members. For instance, IAHR committee meetings, often held at major events like the IAHR world congresses and the flagship symposium of each specific technical committee, are typically open to all conference participants. Similarly, the UNCCD CLPs and the IDMP CoP have organize dozens of such events and mingles during major water conferences like the Stockholm World Water Week or the World Water Forum. This allows individuals who may have an interest but are not yet familiar with the community's work to engage and learn more about their activities. The Global WEF Nexus Community has been doing a podcast that purposely recruits early career nexus researchers instead of mobilizing the usual suspects. This approach helps this community welcome new members and brings fresh and diverse perspectives, enabling them to challenge existing theories and explore double and sometimes triple-loop learning. One of the plans for the WEFE4MED CoP is to start a mentoring and internship program for graduate students to learn from experienced practitioners and researchers.

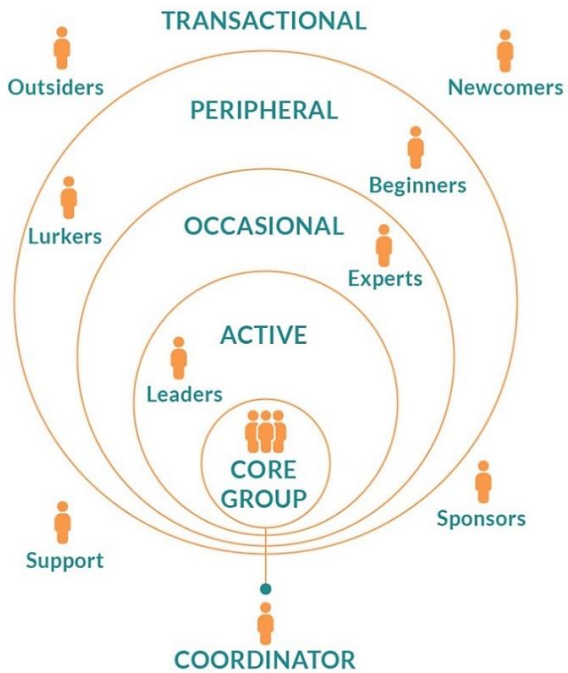

Figure 5. Community Structures and Boundaries (Source: GWP (2022)).

Table 1. The Value Creation Framework (Source: Adapted from Wenger et al. (2011) and Wenger-Trayner (2017)).

Values		Description
Relational: Improving how people exchange and work together	**Immediate:** Your experience of engaging with the community.	This includes the direct value derived from activities and interactions such as meeting someone new with whom you share similar interests, having an insightful conversation, feeling valued and respected by peers, getting excited about what you are working on, etc.
	Potential: What you got out of it.	This highlights the value of learning from others, such as discovering new resources, tools, or tips relevant to your work. It also emphasizes the importance of feeling connected to a group and knowing that support is available from other members—for example, being able to ask questions, request information, or feel privileged access to knowledge through your group or platform.
Technical: Improving how people make decisions and actions to manage the resources	**Applied:** What did you do with it?	This value reflects how your practices have evolved due to the information and knowledge gained from the community or network you belong to. It could involve applying a recommended tool, reusing presentation slides, or adapting training exercises. It might also include experimenting with a new procedure based on a shared tip or pursuing a new collaboration with a fellow community member.
	Realized: The result of having applied it.	The realized value comes from the effect and achievements of adopting the newly applied practice. Performance improvements can be about increasing output or productivity, including saving time, but they can also be about avoiding mistakes, reducing overlaps, filling gaps, or resolving conflicts.
Transformative: Changing how people think and approach water management	**Internal:** The deeper effect it had on you and other CoP members.	The internal transformative value relates to changes in mindsets and perceptions the CoP generates for its members. This can reveal itself as a growth in the ability to speak confidently about an issue, a sense of agency, reconfiguration of personal identities, a new attitude or preference, etc.
	External: The broader societal effects are seen beyond the CoP structures.	External transformative value refers to how CoPs foster broader societal changes that redefine our measures of success. This can take the form of paradigm shifts, the creation of new policies, plans, or strategies, changes in collective behavior, shifts in moral or cultural values, or redistributions of power among groups and institutions.

4.4. Outcomes: What values do water-related CoPs generate?

The analytical model presented in this study builds on the VCF framework to categorize the various effects that a water-related CoP can produce. As originally developed by Wenger et al., (2011), the VCF identifies five types of values generated by CoPs. First, CoPs produce "immediate value", namely, the excitement and the feeling of being connected/understood by others as members get acquainted to each other through participatory learning activities. Second, there is the "potential value", which relates to getting a mental pool of new tools, tips, and ideas but also personal connections that individuals get through their community participation. Third, CoPs produce "applied value" that concerns the changes in individual and collective practices or decisions informed and influenced by knowledge and insights gained from the community. Fourth is the "realized value" emerging from performance improvements that result from having applied new practices suggested by the CoP. Finally, there is the "reframing value" that focuses on the broader transformative effect that CoPs can trigger through its influence on people and practices.

To better situate the VCF in the context of water management, we have grouped those values into three broader buckets (Table 1). Since the 'immediate' and 'potential' values deal with how people exchange and work together, we decided to group those into "relational outcomes". The 'applied' and 'realized' values were brought together as "technical outcomes" as they capture the effect of a CoP on how people change how they take decisions and actions in water management. The third group, "transformative outcomes", pertains to the CoP contribution towards reframing how people think and approach water management. Recognizing that the effect of learning can go beyond the social unit where they were generated (Reed et al., 2010), we characterized "transformative outcomes" as either 'internal' or 'external' depending on whether they affect community members only or trigger broader societal changes such as a shift in collective preference or change in policy and organizational structures.

4.4.1. Relational value: improving how people exchange and work together

The consulted CoP leaders have all reported that their community has contributed to improving how people exchange and work together—relational value production. Many of the consulted communities see networking and the ability to connect people who don't normally get the chance to work together as a valuable outcome in itself. This is especially true for a field like water management, where the problem is not necessarily about the lack of tools and hard technical knowledge but about being able to work with people across scales and sectors (Tremblay-Lévesque et al., 2022; Yasuda et al., 2024). Reflecting on the importance of their community and what it brings to its members, a CoP moderator argues that "just connecting people to know each other. It's 80% of the outcome" (participant 21, personal communication 24/04/2024).

That said, online communities have generally reported difficulties generating a true sense of mutual reliance and trust among their members, perhaps especially so for those created amidst the Covid-19 pandemic. This matters as the production of relational value sets the quality of the learning environment and gives the foundation for being able to generate technical and transformative value (Wenger-Trayner et al., 2020). One of the consulted CoP coordinators shared the importance of in-person meetings as part of the process of growing and nurturing the community and how this has created limitations for their community:

> *"Our regional CoP has been around for about nine years, addressing specific topics. Thus, the exchanges have evolved to deepen topics such as water reuse practices and water monitoring systems […] we have pretty much only online meetings, which allows for every three-month exchanges. Although, in the two face-to face meetings, we were able to develop join products and the time for the discussions allowed further connections among participants, despite that only half of the leadership was able to come"* (participant 10, personal communication 17/04/2024).

Building relationships among CoP members takes time and requires repeated interactions over an extended period (Ikioda, 2014). For many CoP managers, the pandemic highlighted the importance of informal face-to-face interactions, such as coffee break conversations and post-workshop dinners, in fostering genuine relational value within their communities.

4.4.2. Technical value: improving how people take decisions and action to manage the resources

Almost all consulted CoP leaders had stories about how their community has contributed to changing water-related practices and decisions. The WASHLAC Group[20] provides a good illustration of a CoP's direct contribution to the uptake of new practices based on the knowledge produced via a CoP:

> *"When COVID started, we [core group CoP members, in partnership with the academia] developed a regional study, to collate the COVID response measures by 26 countries in the region[21]. The measures were categorized using an analytical framework, depending on whether they were intended to support service users, households and institutions, or service providers, and it was disseminated and discussed in the WASHLAC network[22]. The research has been fundamental in several countries to develop a response framework for WASH in the face of COVID.* (participant 20, personal communication 24/04/2024).

This is also the case of the HEPEX community[23] which has played a significant role in promoting the uptake and use of probabilistic and ensemble techniques in various hydrological applications, including the European Flood Awareness System, now an operational service, and the Hydrologic Ensemble Forecast Service in the United States,

which has been used since the 2010s for forecasts ranging from sub-daily flood events to seasonal streamflow outlooks (Ramos et al., 2018).

New projects and collaborations are additional illustrations of technical outcomes produced by CoPs operating in the field of water and environmental management. A member of the AGUASAN community expressed that the CoP has been an excellent platform for individuals to explore new collaborative opportunities together:

> *"people were discussing when they were exchanging knowledge. They were suddenly like ohh, this is a new box that we are opening up. You know this new kind of adaptation measure, and since there's the funder in there is an implementer in. There's an academic in they were like ohh, why didn't we just quickly sit together and work this out"* (personal communication, participant 24, 25/04/2024)

A concrete example is the student exchange programme established between universities in Tajikistan and Kazakhstan after representatives met in a workshop organized by the Central Asian CoP on the WEFE Nexus (participant 13, personal communication, 19/04/2024). Members of the CoP also organized a joint international conference on the theme of "Water for Peace" to celebrate World Water Day 2024 together, out of which a collection of several scientific articles and technical references were published (CAREC, 2024).

Adopting new practices and projects has also led to performance improvements such as reducing duplication, cutting costs, saving time, and other forms of "realized" value. For instance, after discovering that they were working on similar issues and engaging an overlapping number of international experts, two demonstration site coordinators from the WEFE4MED community decided to co-host a webinar series. This collaboration allowed them to share responsibilities and save considerable time. Similarly, other project leaders who are members of this CoP opted to hold their project closure conferences as a joint event, enabling them to reach a larger audience within the same budget. The World Bank Water Communities have also accelerated technical support services, allowing countries to receive advice and information within days, rather than the weeks or months normally taken through regular bureaucratic technical assistance processes (personal communication, participant 29, 24/05/2024).

4.4.3. Transformational value: changing how people think and approach water management

Aligned with King et al. (2023), we propose that communities can change the way individuals and groups think and approach water management, which by extension may ignite paradigm shifts. As hitherto mentioned, transformational change can manifest itself in a person or group but also in the form of a system-wide shift, such as seen with new policies or power structures. At the individual level, we can reasonably argue that communities built

around specific paradigms such as integrated drought management (UNCCD and IDMP communities), the WEFE Nexus (WEFE4MED and Central Asian CoPs), or nature-based solutions (NbS in Water Management CoP) have helped clarify and popularize their respective concepts within and outside their CoPs, thus contributing to a gradual paradigm shift within their respective domains (personal communication, participant 34, 04/06/2024). They have also appeared to be mechanisms for self-realization and empowerment, as with the Global WEF Nexus Community, which has helped early career researchers gain agency and recognition as technical experts and leaders in their field.

As communities are embedded within broader systems and structures, transforming people's mindsets, however, is almost always only partially traceable to the social learning that a community helps generate. In this light, one of the CoP coordinators shared that they would be worried about claiming much when changing how people think about water management (personal communication, participant 4, 09/04/2024). This is not to say that CoPs don't produce transformational change at the individual level. Still, cognitive shifts take time and normally happen through engagement in multiple social learning spaces. Based on the interviews, most CoP leaders are, however, too limited in their current monitoring and evaluation (M&E) capacities to disentangle when and how influential their community has been in contributing to changing its members' mindsets.

CoP leaders and experts consulted were likewise very careful in claiming attribution in policy change. Stories about their work, however, reveal key contributions and input into policy change processes. This holds especially for communities where members are embedded within governmental structures such as the UNCCD CLP mostly composed of national focal points and where the common practice is centered around enhancing drought policy processes and institutional structures. Using the community as a peer-to-peer coaching mechanism, the UNCCD CLPs are actively supporting the preparation and enhancement of national drought plans across the world, including the preparation of regional drought management strategies (UNCCD, 2024). Other communities, such as the Open Government CoP and the WASH LAC Group, which have engaged several governmental representatives, have also directly contributed to policy outputs like ministerial declarations and new standard operating procedures for governmental agencies (personal communication, participant 20, 24/04/2024).

Interviews revealed that one of the key areas where CoP have demonstrated transformational value is in reshaping organizational learning culture and power dynamics within institutions. The IDMP and World Bank Water Communities are prime examples of how these communities are transforming the interactions between sponsoring organizations—the WMO and GWP for the former, the World Bank for the latter—and their country counterparts, who are now seen as co-learners rather than mere recipients of knowledge. In the case of the IDMP online community, the operational framework of the program is being shifted, fostering a new type of relationship between international organizations, their counterpart

ministries, and the national experts and scientists collaborating with them. The CoP platform has also altered the power dynamics, enabling member states to bypass the secretariat for technical assistance and instead engage with one another as equal learning partners. As one CoP facilitator mentioned, the ultimate goal for the IDMP community is to reach a point where "we [the secretariat] won't need the help desk anymore, and people will just interact within the community" (Personal communication, participant 34, 04/06/2024). This shift is also evident in the World Bank Communities, where CoPs are transforming previously "vertical" relationships into "horizontal" ones, positioning the Bank as a facilitator rather than a provider of knowledge (Personal communication, participant 29, 24/05/2024). This highlights the transformative potential of CoPs in reshaping how major international water management organizations approach capacity development and technical backstopping.

5. Conclusions

This research developed an empirically grounded analytical framework that helps examine how CoPs may operate and produce tangible outcomes through social learning in water resources management. A practical application of this framework is its utility in identifying key functional competencies for community management. Using the schematic elements of this framework as a reference, we created a checklist comprising of eight areas that leaders of water-related CoPs should prioritize (Table 2). While this checklist does not guarantee a community leader's success, it can help them address key design questions and anticipate common challenges in establishing and maintaining their communities (Carvajal et al., 2008). Although the framework and checklist are rooted in the experiences and stories of water-related CoPs, they can be adapted and applied to communities in fields beyond water management.

Using this checklist alongside the information gathered during our consultations, it appears that CoP leaders tend to perform most poorly in the functional competencies related to M&E of outcomes. Among the 33 experts interviewed, only 16 could attribute impacts to their CoPs beyond generating relational value, and just 5 reported achieving transformational outcomes. This gap can be partly attributed to the challenges of assessing technical or transformational impacts, which typically require collecting qualitative data—a process that demands time, resources, and pre-established M&E frameworks. Interestingly, the five communities that successfully tracked transformative outcomes were also the only ones with well-developed methodologies for collecting and analyzing qualitative data from their participants.

Table 2. Checklist of Key Functional Competencies for Water-Related CoPs Coordinators

Context

- ✓ Monitoring the bio-physical environment while aiming to identify potentially relevant hydrological events, pressures, and challenges that can be used to draw attention and generate community momentum.
- ✓ Scoping the socio-political environment to seek alignment between the CoP and politico-institutional processes, strategically positioning the relevance of the community towards realizing broader societal interests and ambitions.

Processes

- ✓ Identifying the types of questions that keep community members up at night and ensuring that the learning pursued by the CoP is oriented towards matching those needs.
- ✓ Analyzing the community's learning needs and pursuing learning orientation while considering available resources to inform which aspects of experiential learning should be prioritized.
- ✓ Seeking to identify a balanced membership model and community size that is consequent with the social learning ambitions and change that CoPs members are aiming to realize.

Outcomes

- ✓ Assessing the extent to which CoP activities and engagements allow people to meaningfully get to know each other and exchange their knowledge and experiences.
- ✓ Evaluating the level to which CoP members are changing their practices and analyzing the impact of those new ways of doing.
- ✓ Monitoring how the CoPs trigger and contribute to transformational change that manifests itself within and outside the community structures.

To address this, a practical recommendation for water-related CoP facilitators is to use the value-creation story matrix template developed by Wenger et al. (2011). This ready-made framework helps gather and process individual accounts to form a comprehensive picture of the value generated by a community. Communities like the UNCCD CLPs and the Central Asian CoP on the WEFE Nexus have successfully implemented this template as the foundation for their M&E frameworks, documenting compelling transformative impacts. Additionally, CoP facilitators can employ online surveys with multiple-choice and scale ranking questions to evaluate learning outcomes from events, as done by IDMP CoP and UNCCD CLPs. Such M&E tools are often used in CoPs in healthcare (Jiménez-Zarco et al., 2015; McLoughlin et al., 2018) and education (Tseng et al., 2014). Furthermore, CoPs with online platforms should monitor metrics like downloads, views, and exchanges, a practice widely adopted in the development sector over the past two decades (Thoto et al., 2017; Ijjasz-Vasquez et al., 2024).

Finally, we would like to highlight two key issues that we were unable to address within the scope of this paper, but we believe present promising directions for future research. One limitation of our framework is that it did not explore how power dynamics and the politics of learning play out within water-related CoPs (Biesta, 2018; Rerup & Zbaracki, 2021). Several CoP leaders we consulted mentioned facing considerable challenges in trying to align perspectives and build consensus in defining the learning agenda of their CoP. Future research could delve deeper into these negotiation processes, exploring who decides what should be learned, how it should be done, and how these issues are discussed, negotiated, and agreed upon (Keen et al., 2012). Noting that most of the CoP leaders we interviewed facilitated online communities, it would be interesting to explore how the politics of learning manifest differently in virtual versus face-to-face CoPs.

Another connected issue that warrants attention is, how to deal with the multiplicity and increased instrumentalization of CoPs in the water space. Although CoPs are traditionally conceived as self-organizing (Catana et al., 2021), our research revealed that many water management CoPs are established by sponsoring organizations, most of which are based in the Global North. As the number of CoPs in the water space grows, the risk of duplication and competition between communities also rises. However, few studies examine how water-related communities impact one another in competitive settings, including how creating new communities or networks can sometimes undermine previously well-functioning ones (Ikioda, 2014). As only two of the communities that we interviewed were self-grown, one future area of work could be to study from their perspective what happens when new sponsored communities are established. This also calls for a deeper analysis of CoPs' ecosystems within specific water domains, including the impact of collaboration, coordination, and competition on learning across the landscape of water-related practices. Lastly, this also highlights the need for greater focus on the decolonization of knowledge and to analyze the critical role that sponsors play in either fostering equitable knowledge systems or perpetuating unequal patterns of knowledge creation and utilization (Boyes et al., 2023).

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Annex 1. Examples of CoPs Related to Water Resources Management.

Clusters	Name	Description	Scope
Water Sanitation and Hygiene (WASH)	AGUASAN CoP	**Domain:** Promote wider and deeper understanding of key issues in water and sanitation in international cooperation. **Practice:** Regular face-to-face workshops, quarterly one-day knowledge exchange events, position papers. **Community:** Swiss-based water and development practitioners, or those professionals working in a Swiss-based organization	• Switzerland • 51 members
	SUSANA Working Groups	**Domain:** Promote a shared vision on sustainable sanitation towards achieving the Sustainable Development Goals. **Practice:** Yearly in-person meeting, trainings, webinars, conferences. podcasts, e-compendiums. **Community:** Sanitation sector professionals, policy makers, researchers.	• Global (with regional chapters in India, West Asia and North Africa, Africa, Latin America) • 15,000+ members
	WASH LAC Group	**Domain:** Strengthen sectoral coordination and response capacity of the WASH sector at national and regional level in emergencies, resilience building risk reduction, and disaster preparedness. **Practice:** In person and online training, technical assistance, bulletins **Community:** National government, UN, INGO, National NGOs, water supply operators, academics, donors.	• Latin America and the Caribbean • 1,400+ members
Water-Energy-Food (WEF) Nexus	Central Asian CoP on the WEFE Nexus	**Domain:** Ensure water-energy-food-ecosystem security in Central Asia. **Practice:** Mentoring program, expert and project database, creation of surveys, collection of knowledge products, online courses. **Community**: representatives of educational and research institutions, government agencies, international	• Central Asia • 34 members

		organizations, youth and other stakeholders.	
	WEFE4MED Nexus CoP	**Domain:** Foster the adoption of a Water-Energy-Food-Ecosystems (WEFE) Nexus approach in the Mediterranean. **Practice:** Identification and dissemination of demonstration sites, conferences, policy briefs, matchmaking, webinars, competitions, courses. **Community:** Practitioners, scientists, policymakers, civil society, media, entrepreneurs, innovators, and investors.	• Mediterranean • 112 Members
	Global WEF Nexus Community	**Domain:** Build capacity and generate transdisciplinary thinking on water, energy, food, environment, health, and climate change. **Practice:** Summer schools, webinars, training workshops, symposia, podcasts, blogs. **Community:** Researchers (early-, mid- and senior-career), postgraduates, policymakers, practitioners.	• Global • 1065 Members
Water-Related Disaster Management	EOTEC Communities	**Domain:** Increase the use of Earth information in decision-making on climate change and disaster management. **Practice:** Webinars, tools and guidance, collection of real cases and application of earth observation, conferences and events, training workshops. **Community:** Capacity development managers, trainers, educators or professionals and subject matter experts interested in EO-related capacity building.	• Global (with regional CoPs for Africa, Americas, Asia) • 236 Members
	IDMP CoP	**Domain:** Foster the adoption of Integrated Drought Management based on the three pillars approach. **Practice:** Virtual exchanges, in person annual meetings/conferences, technical discussions, online courses.	• Global • 103 members

		Community: Drought technical experts, academia, and other practitioners from different sectors and levels.	
	UNCCD Community of Learning and Practice (CLP)	**Domain:** Support drought preparedness systems and national drought plans and working together at the regional level to reduce drought vulnerability and risk. **Practice:** webinars, conferences, workshops, serious games, courses, photo and case study competitions, case clinics. **Community:** UNCCD National Focal Points, national governmental officials and experts and other professionals interested in drought, UN experts	• Global (with 5 regional CoPs in Asia, Africa, Latin America, Central and Eastern Europe and North Med.) • 240 Members
Water and Environment	Nature Based Solutions (NbS) in Water Management CoP	**Domain:** Build recognition on the use of nature-based solutions in water management, particularly for disaster management and wastewater treatment. **Practice:** Blogs, discussions, interviews, webinar series, funding opportunities. **Community:** practitioners, governmental authorities, young professionals working in NbS for flood and drought management and wastewater.	• Global (with a regional focus on Central and Eastern Europe) • 149 members
	ElAguaNosUne CoP	**Domain:** Promote sustainable and responsible water consumption though monitoring, corporate water stewardship, and ecosystem conservation. **Practice:** Technical guidelines, conceptual and regulatory analyses, recommendations, online events, youtube channel, and courses. **Community:** Professionals and practitioners from the public and private sector, civil society, academic or research institutions, consultants, water funds, among others.	• Latin America • 290 Members

	IAHR Communities	**Domain:** Foster research and technical applications in hydro-environmental sciences. **Practice:** Symposiums, conferences, workshops, draft technical reports, joint publications. **Community:** Water and environmental researchers, specialists, and practitioners.	• Global • 5000+ members

Annex 2. List of Interviewed CoP Experts.

No	Stakeholder Type	Community Affiliation(s)	Community Role(s)	Interview Date
1	Intergovernmental Organization	NbS in Water Management, UNCCD CLP	Community leader/moderator	22.03.2024
2	University/Research Institute	WEFE4MED	Core group member	27.03.2024
3	University/Research Institute	SDG IWRM	Expert	08.04.2024
4	University/Research Institute	NbS in Water Management	Community leader/moderator	09.04.2024
5	Intergovernmental Organization	SDG IWRM	Community leader/moderator	12.04.2024
6	Intergovernmental Organization	SDG IWRM, Transboundary	Co-Moderator	12.04.2024
7	Intergovernmental Organization	WEFE4MED, UNCCD	Knowledge manager	12.04.2024
8	University/Research Institute	EOTEC DevNet	Community leader/moderator	16.04.2024
9	Private Sector	EOTEC DevNet	Community leader/moderator	16.04.2024
10	Governmental Organization	El Agua Nos Une	Sponsor	17.04.2024
11	Governmental Organization	El Agua Nos Une	Community leader/moderator	17.04.2024
12	Governmental Organization	El Agua Nos Une	Community leader/moderator	17.04.2024
13	International Organization	Central Asian CoP on the WEFE Nexus	Community leader/moderator	19.04.2024
14	International Organization	Central Asian CoP on the WEFE Nexus	Community leader/moderator	19.04.2024

15	International Organization	Central Asian CoP on the WEFE Nexus	KM Manager	19.04.2024
16	International Organization	IAHR Communities	Sponsor	19.04.2024
17	Intergovernmental Organization	SDG IWRM Community	Core group member	19.04.2024
18	Private Sector	BONEX, WEFE4MED	Community leader/moderator	23.04.2024
19	Private Sector	BONEX, WEFE4MED	Advisor	23.04.2024
20	International Organization	Open Government CoP, WASH LAC Group	Community leader/moderator	24.04.2024
21	Intergovernmental Organization	Transboundary Knowledge Hub	Community leader/moderator	25.04.2024
22	University/Research Institute	SUSANA, IWA Community, Aquasan	Community leader/moderator	25.04.2024
23	University/Research Institute	SUSANA, Aquasan	Community leader/moderator	25.04.2024
24	Intergovernmental Organization	WASH LAC	Community leader/moderator	29.04.2024
25	Governmental Organization	SUSANA	Sponsor/Advisor	03.05.2024
26	Private Sector	Central Asian CoP on the WEFE Nexus	Sponsor	06.05.2024
27	Private Sector	Central Asian CoP on the WEFE Nexus	Sponsor	06.05.2024
28	Intergovernmental Organization	World Bank Water Communities	Community leader/moderator	24.05.2024
29	Intergovernmental Organization	World Bank Water Communities	Community leader/moderator	24.05.2024
30	Intergovernmental Organization	IDMP	Sponsor	27.05.2024
31	Intergovernmental Organization	IDMP	Community leader/moderator	27.05.2024
32	Intergovernmental Organization	IDMP	Community leader/moderator	04.06.2024
33	University/Research Institute	Global WEF Nexus CoP	Community leader/moderator	11.06.2024

[1] https://www.floodmanagement.info/e2e-ews-ff-community-of-practice-area/
[2] https://connect.newibnet.org/
[3] https://www.opengovpartnership.org/community-of-practice-on-water-and-open-government/
[4] https://iwrmactionhub.org/connect/communities
[5] https://droughtclp.unccd.int/clp/home

[6] https://iwa-network.org/iwa-specialist-groups/
[7] https://iwrmactionhub.org/pt-pt/group/naturebasedsolutions/about
[8] https://www.riverbp.net/eng/community_of_practice/profile/about/
[9] The NbS in Water Management CoP has a regional focus on Central and Eastern Europe, though it remains technically open for experts across the world to join.
[10] https://www.iahr.org/index/committe/14
[11] https://www.iahr.org/index/technical
[12] https://www.droughtmanagement.info/idmp-community-of-practice/
[13] https://wefe4med.eu/wefe/home
[14] https://bonex-prima.eu/wefe-nexus/#community-of-practice
[15] https://www.linkedin.com/groups/9530027/
[16] https://thewaternetwork.com/organization-c6k/aguasan-vAQIs962k2aXf2ysoZi4Dg/home
[17] https://iwrmactionhub.org/group/armeniadrought/about
[18] https://forum.susana.org/
[19] After realizing that this was slowing down the community's work, the CoP coordinators decided to stop having a formal admission process and adopt a click and join approach. They now moderate the website weekly, deleting fake accounts and irrelevant materials (personal communication, participant 15, 30/10/2024).
[20] https://www.washlac.com/eng
[21] https://siwi.org/latest/siwi-publication-receives-best-of-unicef-research-2022-award/
[22] https://siwi.org/wp-content/uploads/2020/04/Covid-19_WASH_EN_Basic-note.pdf
[23] https://hepex.org.au/