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Food for Thought

Co-designing marine science beyond good intentions: support stakeholders' empowerment in transformative pathways

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Calls for science to innovate by including stakeholders' in the creation of marine knowledge have been rising, to create impact beyond laboratories and to contribute to the empowerment of local communities when interacting with marine and coastal ecosystems. As a transdisciplinary group of scientists working on co-designing research projects, this paper draws upon our experiences to further define the concept and seek to improve the process of co-design. We highlight the key barriers for co-design processes to contribute to increasing stakeholders' capacity to produce intended effects on marine policy. We suggest that stakeholder engagement requires overcoming the resistance to non-scientific knowledge sources and considering power asymmetries in the governance and management of the ocean. We argue that power and politics must be placed at the very heart of the production of a co-designed marine science and must be an aspect of the facilitation itself. In this paper, we aim to provide insights to navigate throughout the journey of stakeholder engagement, with the critical perspective necessary to make this process socially and environmentally effective.

Keywords: co-design, indigenous and local knowledge, science-policy, social-ecological systems, stakeholder engagement, sustainability pathways.

Introduction

The United Nations Decade of Ocean Science for Sustainable Development (2021–2030) defines co-design as the process of engaging stakeholders' in research projects, "a process that will enable transformative science" (IOC-UNESCO, 2021). Indeed, shifting to a solution-oriented science in strong interactions with stakeholders' (Döring and Ratter, 2015) is now considered as necessary to face the global and complex challenges of unsustainability pathways (Mazé, 2020). This "new" science, also called "post-normal science" (Funtowicz and Ravetz, 1994; Ravetz, 2011), is based on the assumption that science must reinvent its relationship with the non-academic world, considering the fact that conventional scientific methods failed to address significant social and ecological issues (e.g. such as marine biodiversity degradation, sea-level rise, loss of cultural heritage, and ocean acidification), although these issues were initially framed by traditional sciences (Turnpenny *et al.*, 2009). Co-design would be one lever for science to better contribute to the societal revolutions towards sustainability (Olsson *et al.*, 2014), and it is particularly called upon by the ocean community to "design credible and legitimate ocean knowledge solutions" (IOC-UNESCO, 2021). However, in many cases, co-designed scientific projects do not live up to their objectives of stakeholders' empowerment and societal transformations (Turnhout *et al.*, 2020). Thus, co-design is a movement in the history of science and in the epistemology of sustainability science (Ceschin and Gaziulusoy, 2016), which must be considered through a critical perspective to make this process both socially and environmentally effective (Mazé, 2020).

As a transdisciplinary group of scientists working on co-designing research projects, we aim to draw upon our experiences to further define the concept and to improve the process of co-design. Our objective is to ensure that future co-designed projects support the political capacity of Indigenous Peoples and Local Communities (IPLCs) to accelerate their involvement in the transformation towards sustainability (Virtanen et al., 2020) but also the legitimization of their knowledge and modes of governance of marine and coastal resources and territories, beyond the injunctions to achieve collaboration. We consider that Western science is not always able, alone and in its historical, inherited functioning, to answer the global and local challenges related to the ocean. Integrating other groups of actors, taking into consideration the plurality of knowledge and onto/cosmogonies/logies (held and produced locally), and considering that local communities possess strong capacities

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to self-govern their commons (Ostrom, 1990; Armitage *et al.*, 2017) despite non-negligible past and present tragedies (Hardin, 1968) are epistemes' prerequisites.

What co-designing means to us

The notion of co-design entails significant stakeholder participation in research projects, but also the hybridization of different types of knowledge with the aim of collective learning (Fabricius and Cundill, 2014). Collective learning processes involve knowledge sharing between actors at different scales. This concept is mobilized in the literature on resilience and in international environmental organizations such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (Kofinas, 2009; Tengö *et al.*, 2017). Although we consider scientists as a group of stakeholders who are influencing, being influenced by, and possibly identifying as belonging to other stakeholder groups, here, co-design describes the interface between scientists and non-academic actors identifying as IPLCs. Co-design is an adaptive concept, and stakeholder participation can occur at one stage or throughout all stages of project development, knowledge creation, implementation, and dissemination. The process of co-creating knowledge should take place in a climate of trust and should benefit all parties involved. Co-design should not be a simple justification for the usefulness of science by extracting stakeholders' knowledge, but a direct and concrete way to improve sustainability in IPLCs through collective learning (Yahara *et al.*, 2021). The integration of local knowledge through the direct, concrete, equitable (Bennett, 2018), and long-term involvement of stakeholders' (Rölfer *et al.*, 2022) is necessary for the transformations of marine and coastal socio-ecosystems (d'Hont and Schlinger, 2022). Since knowledge plays a central role in the decision-making process, participating in knowledge production through the academic system can be a lever for empowering local communities to take an active role in shaping the policies for sustainability (Ragueneau *et al.*, 2018). Yet, the impact of co-designing marine science projects on stakeholders' ability to make their voice heard is variable. While undertaking co-designed marine science projects, we were able to identify different factors that can limit the potential of successfully merging Indigenous, Traditional, and Local knowledge (Roué, 2012) and Western science (Mazzocchi, 2006) to improve stakeholders' capacity to influence marine policies.

Barriers to stakeholders' empowerment

The objective of bridging multiple types of knowledge to improve stakeholders' capacity to manage their marine socio-ecosystems can be hindered when the project fails to integrate power asymmetries and their impact on stakeholders' participation and on the projects' outcomes. The interactions within the co-design interface are influenced by the socio-economic context in which the marine science projects take place and by the social identities of the scientific and non-academic actors. Political positioning directs the course of participation, and power relations can influence the impact of different actors on the process of co-design. This is even more tangible when pursuing international projects, where researchers' and stakeholders' nationalities are associated with tensions from colonial history. We observed that in such situations, imposing concepts, terminology, and tools can lead researchers to disregard key elements to understand the socio-ecosystems. For example, researchers can fail to grasp the differences in decision-making and/or institutional arenas, where communities can have specific governance system characteristics, such as pluralities and non-symbiotic co-existence of rights and laws (Novikova, 2005; Lhuillier, 2018). Ultimately, it can degrade trust between the different parties and compromise the ownership over the research by the local communities, and the impact of the project on their capacities to influence marine policies.

We have learned about processes that serve the continued division rather than the co-existence of different knowledge systems. There are many ways of failing to bring together different knowledge systems into a coherent set of solutions that are operational for local communities. It can be by adopting deficient methodologies, which fail to integrate the complexity associated with different cosmologies [taxonomies, vocabularies, categories, and realities (Leete and Lipin, 2015)]. Research is often built on a project-based approach, with specific norms and vocabularies, which is mastered by funding agencies and researchers. Hence, the latter often determine the problem definition, and coordinate the different roles in the project, without systematically analysing whether there are objectives and representations that are both operational and accepted by the different actors. It can also be by underestimating the impact of frictions between different space–time, by using inoperative territorial borders as a scope of analysis, or by failing to grasp the communities' plurisecular vision of human–nature relationships in the limited temporality of the research project agenda. Finally, we have found that anchoring the framing of the project in dichotomous thinking, building a wall between scientists, perceived as the main legitimate knowledge producers, and stakeholders, essentialized as the know-how holders with a contextualized perception of the ecosystem interactions, sets the stakeholders as external actors to a process that is specifically framed to integrate them. Characterizing IPLCs as "the others" tends to invisibilize the overlapping zone between scientists and stakeholders, which can be key in the co-design process. It also raises the question of "knowledge diplomacy" (Adamson and Lalli, 2021), by contributing to maintaining the hierarchical organization of knowledges.

Knowledge diplomacy

The discussions arising from these difficulties can generate a positive impact on the project outcomes, if the friction generates collective learning, which is integrated in the co-designing process (Tafon, 2022).

The issue of power asymmetries must be placed at the heart of the production of a co-designed marine science (Wiebren and Boonstra, 2016; Dahou and Mazé, 2021). Co-designed science has a strong transformative potential, but it must be pursued while considering "power gaps" (Mazé, 2020) as much as "knowledge gaps" (Jasanoff, 2004). The balance of power within the political arena needs to be recognized. Stakeholder engagement requires careful attention when the project involves local communities impacted by colonial history, or other forms of domination (Wiebren and Boonstra, 2016; Mazé *et al.*, 2017; Bennett *et al.*, 2019). Research projects must contribute to the recognition of the rights and cultural practices of IPLCs as essential components of environmental conservation and the sustainable management of natural resources (Pascua *et al.*, 2017; Mawyer and Jacka, 2018). It also

requires researchers to set ethical and respectful, long-term collaboration, with in-depth and regular frequentations of the field, in order to build trust with all stakeholders. By doing so, co-design can play a central role in developing governance systems (Van Assche *et al.*, 2020) that enhance the adaptive and equitable use of natural resources through the distribution of benefits to IPLCs (Kofinas, 2009; Thornton and Scheer, 2012).

The role of the researcher evolves to integrate a mediation dimension, to build a bridge between two worlds, as a diplomat (Stépanoff, 2020), ensuring intersubjectivity, maintaining engagement, and addressing interconnections between so-called legitimate science and other epistemic knowledge. In the case of knowledge confrontation between local knowledge or with Western science (Arango *et al.*, 2022), it is very often the researcher who has the legitimate power to make the final arbitrage by judging whose expertise to use. Thus, it is necessary to overcome the resistance to knowledge sources outside of scientific disciplines in order to move beyond the dichotomous discourse that leads to knowledge inequalities (Turnpenny *et al.*, 2009). Integrating stakeholders at the initial step of the project, when shaping its frame, is also a means to favour the identification of operational solutions to contextualized problems.

Conclusion

Systematic engagement of stakeholders is crucial for researchers to consider the plurality of values and perspectives and to inform the kind of science that is needed to address complex and pressing challenges (Schneider *et al.*, 2019). Co-design is progressively integrated in the agenda, scientifically, but also politically (Escobar, 2018; Gaziulusoy *et al.*, 2021). The co-design of science also has a very strong vocation to convey concepts produced in science to societal actors, empowering them to own the research projects taking place in their territories. Yet, co-design is not a "cure-all" solution for ocean challenges, and ensuring effective co-design requires acknowledging the influences of power inequalities, creating the framework necessary to be in a capacity to share a common vocabulary (Fabricius and Cundill, 2014), and engaging in individual (Berglund and Kohtala, 2020) and collective learning with IPLCs to generate new solutions to ocean challenges.

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Conflict of interest

No conflict of interest.

Data Availability

No new data were generated or analysed in support of this research.

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