

Transnational Governance Frameworks for Sustainable Innovation: The Case Of The Blue Bioeconomy In The Mediterranean

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ABSTRACT: Recent developments in innovation policy have challenged the initial assumptions of Smart Specialisation Strategies (S3), initially aimed at promoting innovation for regional growth. In response to the United Nations Agenda 2030 Sustainable Development Goals (SDGs), the new S3 seeks to address social and sustainable development challenges. The present study sets out to propose an extension of one of these reformed S3 approaches to a multilevel governance setting. The study will propose a governance model suitable to support innovation in the blue bioeconomy –those economic activities related to the living resources at sea–, in the Mediterranean.

Marcos de Gobernanza Transnacional para la Innovación Sostenible: El Caso de la Bioeconomía Azul en el Mediterráneo

RESUMEN: Desarrollos recientes en las políticas de innovación ponen en entredicho las premisas originales de las Estrategias de Especialización Inteligente (S3), inicialmente dirigidas a apoyar la innovación para el crecimiento económico regional. En respuesta a los Objetivos de Desarrollo Sostenible (ODS) de la Agenda 2030 de Naciones Unidas, las nuevas S3 buscan atacar retos de desarrollo sostenible y social. El presente estudio propone la extensión de una de estas nuevas S3 a un entorno de gobernanza multinivel, avanzando un modelo de gobernanza que apoye innovación en la bioeconomía azul –actividades económicas relacionadas con recursos marinos vivos–, en el Mediterráneo.

KEYWORDS / PALABRAS CLAVE: Blue bioeconomy, innovation policy, sustainable development challenges, transnational governance, multi-level governance / Bioeconomía azul, política de innovación, retos de desarrollo sostenible, gobernanza transnacional, gobernanza multi-nivel.

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1. Introduction and goals

Smart Specialisation Strategies (S3) have been since their launch in the previous programming period (2014-2020), the cornerstone element of regional innovation policy within the EU Cohesion Policy. Based on an entrepreneurial discovery process (EDP) –the search by entrepreneurs and other stakeholders of promising domains for innovation, spanning technologies, skill sets and sectors, as much unique as possible to the region–, stakeholders co-define the priorities of innovation policies. Drawing on regional strengths, S3 intends to support stakeholders in the identification of related domains, whereby comparative advantage can be realised (Foray, 2009; McCann & Ortega-Argilés, 2015). Thus, despite limitations such as the lack of mechanisms to monitor and redirect the priorities to be pursued, S3 policies are seen as a policy tool to promote stakeholder participation in the definition of innovation paths specific to their regions (Masana & Fernández, 2019; McCann & Ortega-Argilés, 2015).

In recent years, however, policy makers have become increasingly aware of the need for innovation policies addressing sustainable development challenges. The formulation of the Agenda 2030 Sustainable Development Goals (SDGs) by the United Nations (2015) has put social and sustainable development challenges such as the need for sustainable consumption and production and equal economic development opportunities at the centre of the global policy agenda. Within the EU, the emerging Horizon Europe 2030 programme displays similar trends, whereby S3 is expected to help address sustainable development challenges such as restoring marine and in-land water ecosystems (European Commission, 2021a), and equal development opportunities in rural areas (European Commission, 2021b). In parallel, scholars of innovation increasingly see innovation policies such as S3 as a vehicle to address social and environmental problems (Mazzucato, 2016; Molas-Gallart *et al.*, 2021). This shift represents a departure from traditional understandings of innovation policy whereby innovation was mostly pursued as a driver of economic growth, disregarding potential negative impacts in societies and ecosystems, such as increased social inequality and unsustainable consumption and production patterns (Fitjar *et al.*, 2019; Schot & Steinmueller, 2018).

The new S3 policies are thus expected to be more responsible (Ariño & Fernández, 2021; Fitjar *et al.*, 2019), i.e. they are expected to anticipate their positive –and negative– impacts while including the interests and needs of a wide range of stakeholders in their formulation and implementation. Complementarily, they should reflect on their impact and be responsive to emerging needs during implementation. In response to such needs, innovation policies have been redesigned to align innovation towards societal goals and sustainable development. Approaches such as those of transformative innovation policy (Molas-Gallart *et al.*, 2021; Schot & Steinmueller, 2018) and the more recent Shared Agendas for Sustainability and Social Change (Ariño & Fernández, 2021; Marinelli *et al.*, 2021), exemplify the efforts to promote innovation

as a tool to tackle sustainable development challenges. These emerging S3 approaches are also expected to integrate the notion that the innovation –experimentation, diffusion and upscaling of innovations– is likely to take place at different territorial scales, strengthening the need for inter-regional cooperation (Tödting *et al.*, 2020, 2022).

The present study focuses on one of the revised S3 policy approaches, the Shared Agendas for Sustainability and Social Change, or Shared Agendas. These agendas are based on intersectorial cooperation and the generation of shared knowledge between government, academia, companies and civil society, focusing on promoting transformative change and trying to predict the systemic effects of innovations (Fernández & Romagosa, 2020). Departing from the *Shared Agendas* framework, the present study intends to provide an answer to the following question:

- How can the Shared Agendas governance model be extended to promote innovation cooperation on the sustainable development of the blue bioeconomy, across the Mediterranean?

The proposed governance model will be applied to two blue bioeconomy sustainable development challenges present in the Mediterranean; these are those of i) marine plastic debris, as a threat to the preservation of marine living resources; and ii) the introduction of circular economy practices in aquaculture.

The remainder of this article is organised as follows; below, the conceptual framework will be discussed, followed by a description of the methodology. Next, the article advances the governance model proposed, together with its component parts, and proposes how it could be deployed to address the two sustainable development challenges mentioned before. A final section concludes, discussing the implications of the governance model.

2. Conceptual framework

The last years have witnessed an increased interest on the part of policy makers and scholars on the directionality of innovation policy. Policy frameworks such as those of the UN Agenda 2030 (United Nations, 2015) and Horizon Europe 2030 (European Commission 2021a, 2021b) seek to harness the potential of innovation to address sustainable development challenges; while scholars increasingly point to the social and environmental consequences of innovation (Fitjar *et al.*, 2019; Mazzucato, 2016; Schot & Steinmueller, 2018).

This shift towards directionality is also visible in the new wave of S3 policies for the programming period 2021-2027. As part of this shift, responsible research and

innovation (Stilgoe *et al.*, 2013) has become a key component of S3 (Ariño & Fernández, 2021; Fitjar *et al.*, 2019). Consequently, the positive and negative impacts of such policies have to be anticipated, taking into account their economic, social and environmental outcomes. Secondly, a broader range of societal stakeholders has to be included in the formulation and implementation of innovation policy, beyond those traditionally related to economic growth. Hence, innovation policy has moved from a triple helix framework –covering businesses, research institutions and governmental authorities– to a quadruple helix framework, including civil society and citizens. Thirdly, S3 policies are required to reflect on their impacts both within and outside their regions. Finally, they also have to respond to criticism along implementation.

In response to such needs, innovation policies have been redesigned to align innovation towards societal goals and the pursuit of sustainable development. A new understanding of Regional Innovation Systems (RIS) has been proposed, that promotes the alignment of regional innovation priorities to address sustainable development challenges, beyond the pure pursuit of economic growth (Fitjar *et al.*, 2019; Tödtling *et al.*, 2022). The new, challenge-oriented RIS (CoRISs) also integrates the notion that the innovation process –experimentation, diffusion and upscaling of innovations– is likely to take place at different territorial scales, hence involving cooperation between actors located in different regions and countries (Tödtling *et al.*, 2020, 2022). Innovation processes might also take place differently across metropolitan and non-metropolitan regions (Fernández-Guerrero, 2020), strengthening the need for multi-actor coordination.

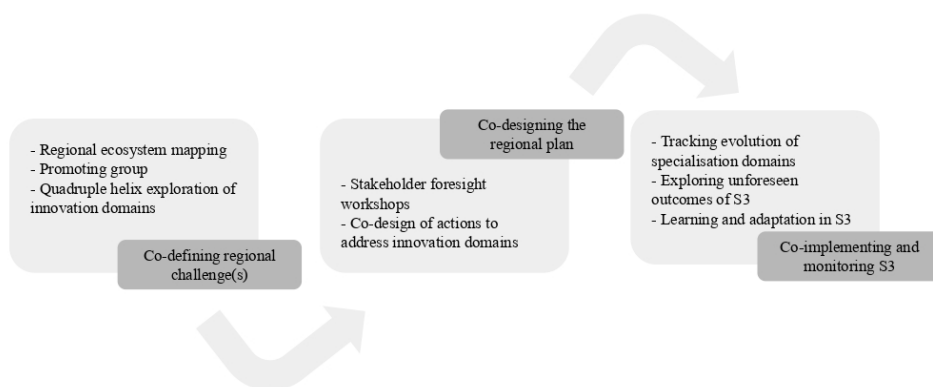
To implement these principles, a reformed S3 has been suggested, whereby the definition by regional stakeholders of the sustainable development challenges to be addressed (Ariño & Fernández, 2021; Fernández & Herrera, 2022) becomes fundamental, together with the monitoring routines that can support multi-stakeholder learning, and the adaptation of S3 (Larrea *et al.*, 2019; Masana & Fernández, 2019). The process is described below, and summarised in Figure 1:

- Firstly, a promoting group launches and steers an EDP whereby quadruple helix stakeholders co-define the challenges and innovation domains (changes in technologies, social practices, organisational routines...) to be addressed in S3. In this part of the process, stakeholders are supported by future-looking workshops whereby they compare alternative future visions.
- The process continues with the design of an action plan to address the challenges, considering the direct and indirect impacts of the specialisation domains pursued. Again, regional stakeholder participation is crucial.
- Thirdly, the S3 policy is implemented, emphasising how monitoring routines can help learning about the positive (negative) impacts of the policy and support the

adaptations required to increase (decrease) them. Ongoing monitoring approaches should be applied in collaboration with stakeholders, focusing on: i) tracking the evolution of specialisation domains, especially those that have an emerging character and cannot be identified by conventional statistics; ii) exploring unforeseen outcomes of the S3.

FIGURE 1

Steps in the implementation of reformed S3 approaches



Source: Adapted from Ariño & Fernández (2021), Masana & Fernández (2019).

Reformed S3 approaches also enable the development of innovation governance arrangements that harness the potential of the blue bioeconomy, to address sustainable development challenges in transnational settings like the Mediterranean. Indeed, such governance models can be built from the Shared Agendas framework (Ariño & Fernández, 2021; Fernández & Romagosa, 2020; Marinelli *et al.*, 2021). This is a reformed S3 framework aimed at promoting inclusive multi-stakeholder coalitions addressing sustainable development challenges, like those related to the promotion of the blue bioeconomy. The framework, although largely regional, can be suited to a transnational setting like that of the Mediterranean, where multiple levels of governance are involved. This is because Shared Agendas are inspired by the transformative innovation policy literature (Molas-Gallart *et al.*, 2021; Ghosh *et al.*, 2021; Schot & Steinmueller, 2018) which, as discussed in more detail below, is grounded in the multi-level perspective of change in socio-technical regimes (Geels, 2002).

A regional innovation strategy based on the Shared Agendas framework departs from a shared vision for a future, where a sustainable development challenge has

been addressed. This vision is to be constructed and shared by a broad stakeholder constituency involving public administration, businesses, universities and research institutions, as well as civil society, through a process whereby these stakeholders come up with a joint definition of the current situation in connection with the challenge. Once the stakeholders come up with a shared understanding of the current situation and a shared vision for the future, an action plan is established, focused on the goals that should be pursued through innovation, to bring the current state of affairs as closely as possible to the shared vision. Additionally, a governance framework helps stakeholders implement in practice the shared vision, by experimenting with alternative types of innovations, technological or not (Ariño & Fernández, 2021; Fernández & Romagosa, 2020; Marinelli *et al.*, 2021).

Within transformative innovation policy, it is assumed that the kind of innovations, technical or not, needed to address a sustainable development challenge are likely to overcome the limitations of the dominant socio-technical regime. Dominant regimes –with aspects such as core technologies, user preferences, regulations or cultural patterns– define the frame of the innovations pursued by society, posing a limitation into its ability to address emerging sustainable development challenges like climate change or access to economic development opportunities in developing countries. Hence the boundaries of the dominant socio-technical regime are likely to be overcome by the diffusion of innovations proposing new ways to address the challenges. For this reason, these innovations offer an opportunity to transform the socio-technical regime towards more sustainable development paths (Molas-Gallart *et al.*, 2021; Ghosh *et al.*, 2021).

Thus, regime transformation towards sustainable development is likely to require the interaction of developments taking place at different territorial scales. Experimentation in local protected spaces should be accompanied by macro-level trends highlighting the limitations of the regime, and creating windows of opportunity innovation diffusion and upscaling (Molas-Gallart *et al.*, 2021; Ghosh *et al.*, 2021).

Shared Agendas, like other challenge-oriented regional innovation strategies, can be useful to initiate the development innovations with regime de-stabilising potential (Tödtling *et al.*, 2022). However, these innovations might still require the involvement of actors operating in other regions, and at national and international levels of governance, in order to upscale. A broad range of multi-level interactions can thus be foreseen, including access to national or EU funds (Tödtling *et al.*, 2020), and cooperation with established players in public administration of industry in order to promote policy changes, gain market access or attract investment (Ghosh *et al.*, 2021).

For these reasons, the multi-stakeholder coalitions defining a shared agenda are likely to take into account developments in other regions, and at higher levels of governance (Ariño & Fernández, 2021; Fernández & Romagosa, 2020). However, while these ex-

tra-regional developments are used to inform the shared agenda, they could also serve as a departure point to transform what is for the most part a regional S3 framework into a fully-fledged multi-level innovation policy framework, aimed at promoting cooperation for transformative innovation across the Mediterranean –thus involving actors operating at different countries and levels of governance in the basin–. Indeed, such cooperation is likely to support the goals pursued by a shared agenda, when it comes to gaining access to resources useful to upscale regime de-stabilising innovations, such as markets, investments, or policy influence.

3. Methodology

The present study is based on a literature review combining the following sources:

- Peer-reviewed articles and grey literature, covering recent developments in S3 strategies, and innovation policy more generally (Fitjar *et al.*, 2019; Molas-Gallart *et al.*, 2021; Schot & Steinmueller, 2018).
- Grey literature, articles discussing the Shared Agendas approach (Ariño & Fernández, 2021; Marinelli *et al.*, 2021; Fernández & Herrera, 2022).
- Grey literature, reports covering the latest developments in the blue bioeconomy, in the Mediterranean (EUMOFA, 2020; Francocci *et al.*, 2019).
- Peer-reviewed articles and grey literature, on blue bioeconomy challenges (Miedzinski *et al.*, 2019; Wayman & Niemann, 2021).
- Grey literature, reports on transnational governance arrangements aimed at addressing sustainable development challenges in blue bioeconomy fields (Auregan *et al.*, 2020; Schultz-Zehden *et al.*, 2021; Quero *et al.*, 2021).

This combination of sources stems from the emerging nature of the field. Indeed, only a fraction of the debates on S3 strategies and the directionality of innovation policy are already part of the debate held in academic journals. Additionally, some sources are directed primarily at a practitioner audience. This is the case of the articles on the Shared Agendas; as well as those covering the blue bioeconomy in the Mediterranean.

The literature review has been carried out in preparation for multi-stakeholder workshops exploring how can innovation cooperation help tackling sustainable development challenges through innovation, as part of the Interreg MED project Blue Bio Med¹ (Fernández *et al.*, 2021). In this context, literature on the Shared Agendas was

¹ The literature review also supports the analysis of the outcomes of the Blue Bio Med workshops. Ultimately, this analysis will inform the development of a governance model for innovation cooperation on sustainable development challenges related to the blue bioeconomy, in the Mediterranean. More information is available on the project website: <https://blue-bio-med.interreg-med.eu/>.

suggested by key informants from the economic promotion area of the Catalan Government; further data on the challenges was provided by the workshop participants.

Based on these sources, a governance model is proposed, whereby the Shared Agendas framework is adapted to address blue bioeconomy sustainable development challenges in the Mediterranean. To improve the empirical grounding of the governance model, it has been advanced how the governance model could be deployed to articulate multi-level stakeholder networks addressing the sustainable development challenges of i) marine plastic debris, as a threat to the preservation of marine living resources; and ii) the introduction of circular economy practices in aquaculture. Per each challenge, the context of the challenge is taken into account, together with useful characteristics of governance frameworks currently implemented to address the challenge.

4. Governance model proposal

Inspired by transformative innovation policy and the multi-level perspective, Shared Agendas (Ariño & Fernández, 2021; Marinelli *et al.*, 2021) propose a methodology that policymakers can apply when coordinating S3-oriented initiatives around sustainable development challenges. Concretely, a narrative should be built, aligning a coalition of stakeholders around a shared vision; and an action plan aiming at its realisation. To be able to address the focal sustainable development challenge, however, broad stakeholder participation shall be ensured.

To ensure the participation of a broad stakeholder constituency at all stages in the implementation of the shared vision, Shared Agendas propose a regional governance framework (Fernández & Romagosa, 2020), based on:

- A strategic committee performing advocacy group and strategic leadership functions. Their functions cover thus the long-term leadership and external representation of the initiative, gathering support for the action plan that should lead to the shared future vision.
- A technical office with functions such as coordinating and supporting actions as part of the action plan to realise the shared vision; designing and managing a monitoring system focused on learning and the adaptation of the action plan; providing equal opportunities for participation; influencing political agendas. The technical office is thus mostly concerned with day-to-day guidance tasks.
- Working groups of stakeholders aligned around alternative innovation portfolios. Having a largely self-governed nature, their number and internal composition vary with stakeholder priorities. They add flexibility and experimentation capacity to the governance model, providing different opportunities to reshape the action plan towards the shared vision.

Shared Agendas depart, like transformative innovation policy (Molas-Gallart *et al.*, 2021; Ghosh *et al.*, 2021; Schot & Steinmueller, 2018), from the assumption that the dominant regime is present at different territorial scales, and global trends such as climate change can open windows of opportunity to innovation.

In response, the proposed transnational Shared Agendas framework is based on a core structure similar to that of a regional shared agenda and working groups. The latter would be divided in policy setting groups -coordinating S3 with other policies at the regional, national and transnational governance levels- and innovation co-creation groups tasked with co-designing and experimenting with innovation projects implementing the shared agenda action plan. These components are defined below.

4.1. Core structure

The strategic committee would be composed of representatives of key actors from the quadruple helix in the Mediterranean, willing to commit the resources –human, material or economic– needed to muster the involvement of a broad multi-level stakeholder base for the formulation, and implementation of the shared agenda action plan. The strategic committee functions involve thus promoting the action plan to external parties while maintaining and gathering additional support for the shared agenda. The quadruple helix nature of the strategic committee is key, to ensure that a broad range of stakeholders feel represented by the leadership of the initiative. Similarly, the members of the steering committee should operate at different levels of governance –mostly, transnationally (at the EU level and across the Mediterranean²); nationally and regionally– to ensure support for innovation projects at different territorial scales. Furthermore, the multi-level presence of the strategic committee members would be all the more relevant, taking into account the need to promote policy coordination across the Mediterranean, when it comes to the blue bioeconomy (Francocci *et al.*, 2019).

The strategic committee resources would also be essential in maintaining a technical office capable of coordinating and promoting learning across working groups. Specifically, the technical office should be able to coordinate a broad range of projects operating at different governance levels and countries across the Mediterranean, monitoring their contribution to the action plan. The technical office’s continuous monitoring would be essential to enhance the Shared Agenda framework’s ability to identify new

² Examples of institutions operating transnationally in the Mediterranean include:

- The United Nations Mediterranean Action Plan (UNEP-MAP). It is an intergovernmental cooperation arrangement supported by the Mediterranean countries and the EU, promoting sustainable development of the region: <https://www.unep.org/unepmap/>
- The member states of the Union for the Mediterranean (UfM) include the Mediterranean countries and the EU; it serves as a forum to agree on the main priorities of sustainable development policies, across the basin. Innovation initiatives labelled by the UfM are endorsed by all its member countries

opportunities for innovation projects or suggest changes along the implementation of existing projects. In parallel, working groups can provide capillarity to the technical office's monitoring tasks, drawing on their extensive knowledge of regional innovation opportunities (see working groups).

4.2. Working groups

Similarly, the working groups would be composed of members operating regionally, nationally and transnationally, and present in different countries across the Mediterranean. Two broad typologies of groups could be distinguished.

Firstly, *policy setting groups* led by policymakers representing government institutions at the regional and national level, as well as the transnational level (EU, Mediterranean). Divided according to specific problems within the challenge, these groups enable representatives from authorities to exchange information about priorities in S3 as well as innovation policies at extra-regional governance levels, in connection with the challenge. Authorities should thus be better prepared to agree on complementary goals, aligning S3 with other policies at the national and transnational levels. Furthermore, regions with different innovation processes and capabilities (Fernández-Guerrero, 2020) could adapt the learning acquired in the group to their context.

The second typology concerns *innovation co-creation working groups*, composed of quadruple helix stakeholder coalitions. Each innovation co-creation group focuses on co-designing, experimenting with, and scaling up a specific range of innovations in connection to the challenge that has been identified by the stakeholders themselves. Their structure might be more flexible compared to that of the policy setting groups; they might emerge, develop and dissolve depending on innovation opportunities. However, the uncertain, long-term processes involved in diffusing and scaling up transformative innovations (Molas-Gallart *et al.*, 2021; Ghosh *et al.*, 2021) also entail that some of the working groups might consolidate into semi-permanent structures.

The innovation co-creation groups would include a broad range of stakeholders during the co-design and implementation of innovations; these groups would follow a social innovation lab structure whereby innovations are co-created and tested in real-life settings, in successive rounds (Fernández & Herrera, 2022). The participation of a broad range of quadruple helix stakeholders would also be essential to exchange in the long run information about innovations with the highest diffusion potential, and securing the resources required to consolidate their scaling up. Furthermore, contrary to the oftentimes local/regional nature of the social innovation labs (Fernández & Herrera, 2022), the innovation co-creation groups are expected to be composed of quadruple helix stakeholders *operating at different territorial scales* –regionally, nationally, and transnationally–, supporting the search for resources needed to develop and upscale innovations, such as market access, investments or policy influence.

Tapping on their quadruple helix nature, the innovation co-creation groups are also expected to include representatives from the policy setting groups. These members should not only provide policy influence capabilities, but they would help the needs from the innovation co-creation groups reach the agenda of the policy-setting groups. Conversely, the presence of policymakers in innovation co-creation groups would also ensure that the latter take duly into account policy developments when searching for opportunities to develop and upscale innovation projects.

Regular collaboration between stakeholders at different governance levels and S3 coordination authorities can increase the learning gathered along S3 implementation, as well as its effectiveness (Larrea *et al.*, 2019; Masana & Fernández, 2019). Similarly, regular meetings between both types of working groups and the technical office would be essential in order to guarantee that the latter is able to monitor changes in the policy setting or the development of transformative innovations and promote learning across working groups on opportunities that might stem from such changes.

Departing from the work carried out within Blue Bio Med (Fernández *et al.*, 2021), the practical implications of the proposed Shared Agendas framework are explored for two case studies of sustainable development challenges related to the blue bioeconomy, in the Mediterranean. These are marine plastic debris, as a threat to the preservation of marine living resources; and the diffusion of circular economy practices in aquaculture.

Per each of these examples, a summary of the context of the challenge is presented, followed by a discussion of multi-level governance arrangements currently deployed to address the challenge. These two sources of information are combined to advance an hypothetical model of how the transnational Shared Agendas framework could be implemented to address the two challenges.

5. Case studies

5.1. Mitigating and eliminating marine plastic debris

5.1.1. Context of the challenge

Macro-plastic waste has been related to deaths by suffocation; while the ingestion of micro-plastic debris is associated with a decrease in the quality of life, reproduction and survival of marine animals. In addition, nano-plastic effects are still being investigated, however they might be able to penetrate biological membranes, disrupting the functioning of cells (Mendenhall, 2018; Wayman & Niemann, 2021). Estimates range from a yearly intake of 230,000 tonnes of marine plastic (Boucher & Billard, 2020) to 570,000 tonnes (WWF, 2019). These figures might appear small compared to global estimates such as the 4.8-12.7 million tonnes advanced by Jambeck *et al.* (2015) or the 14.5 million tonnes raised by Wayman & Niemann (2021), however, the Mediterranean only holds 1 % of the world's waters.

A broad range of technological and non-technological innovations should help addressing the following needs, in connection with the challenge (Ellen MacArthur Foundation, 2017; Miedzinski *et al.*, 2019):

- Improvements in monitoring of marine plastic waste.
- Improvements in the recovery, recycling and valorisation of marine plastic debris.
- Changes in connection with the functioning of waste management systems, circular business practices.
- New social practices involving consumption and disposal of plastic.

5.1.2. Empirical cases of governance arrangements: BlueMed Initiative

The BlueMed Initiative (n.d.-b), an intergovernmental initiative based on the framework of the EU Blue Growth Strategy (2012) and promoted by a range of EU MED countries, launched in 2018 a Pilot Action on a Healthy Mediterranean Sea (BlueMed Initiative, n.d.-a). The Pilot Action intends to map and assess actions regarding plastic pollution in the Mediterranean EU and non-EU countries, promoting the exchange of information on these practices and matchmaking opportunities across governance levels and countries.

Key to the Pilot Action has been the establishment of National Hubs in each of the participating countries (Algeria, Egypt, France, Greece, Israel, Italy, Malta, Morocco, Spain, Tunisia and Turkey); these have been tasked with mapping innovative practices

to address the challenge of marine plastic pollution in the Mediterranean. Over a range of workshops, the hubs have shared these innovative practices, exploring which ones might be further operationalised and scaled up.

Although the Hubs do not function themselves as the living labs, the Pilot Action workshops provide an opportunity for the diffusion of those innovative practices with the greatest scaling up potential. Hence, the Hubs can be related to the *innovation co-creation groups* put forward in the Shared Agendas framework.

Beyond the Pilot Action, other components of the BlueMed Initiative resemble the structure of the proposed transnational Shared Agendas framework, although quadruple helix representation is not guaranteed in all of them:

- A Group of Senior Officials performs *strategic committee* functions, promoting the adoption of strategic research and innovation agenda or SRIA (akin to the shared agenda action plan). Its members include senior officials from national ministries and transnational organisations (EU Commission, Union for the Mediterranean), as well research institution representatives.
- A Coordination and Support Action (CSA) fulfilling *technical office* tasks such as the day-to-day coordination of the initiative working groups (see later) and overseeing the contribution of these working groups and other blue economy actors to the strategic research and innovation agenda. Its members are research organisations, research funding agencies and ministries.
- Lastly, the BlueMed Initiative includes four thematic platforms, promoting innovation cooperation across stakeholders and governance levels in the following domains: policy (science-policy links), knowledge (knowledge of Mediterranean dynamics and ecosystems), economy (economic sectors of blue economy), and technology platform (enabling technologies for Blue Growth in the Mediterranean). The members of the thematic platforms include the national quadruple helix representatives, as well as representatives from the CSA; this membership composition supports the diffusion of innovations that can contribute to implement the SRIA. Because governmental representatives are present in all the thematic platforms, these combine functions of *innovation co-creation groups and policy setting groups*.

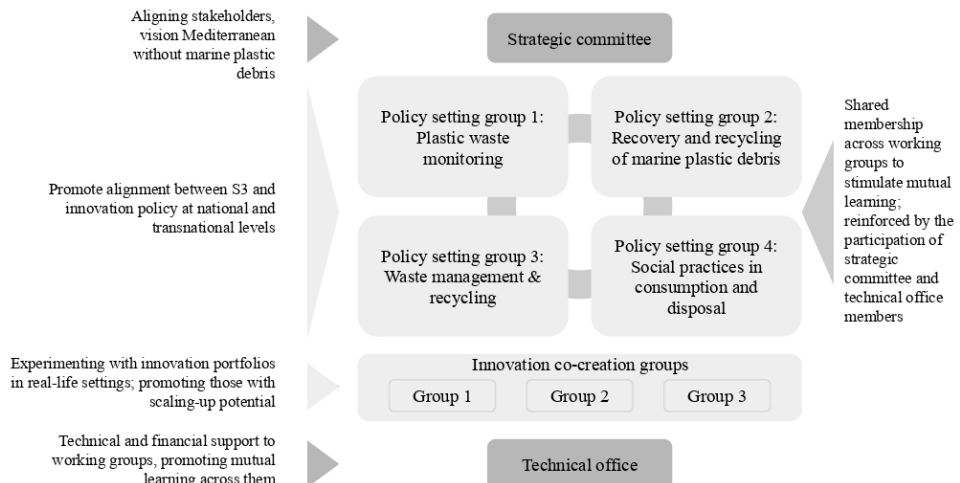
5.1.3. Proposed Shared Agendas framework

Based on the context of the challenge and the case of the BlueMed Initiative, a shared agenda framework suited to the challenge is put forward (Figure 2):

- The policy setting groups promote alignment between S3 and other governance levels for each of the policy needs considered transversal to the challenge. Crossed membership could be promoted between these groups to stimulate coordination between them; with similar goals in mind, members of the policy setting groups could also be present in the innovation co-creation groups.
- Members of the strategic committee and the technical office could be involved in the innovation co-creation and policy setting groups. In this way, the needs of the working groups would feed into the day-to-day coordination carried out by the technical office, and the strategic committee's external advocacy work.
- Conversely, multi-stakeholder presence might not only be relevant in the strategic committee but might also be considered for the technical office. Given their scientific expertise on the challenge, research institution stakeholders are expected to lead the work of the technical office; however, a minimal, permanent presence of members from the working groups should be assured in order to guarantee that the views of quadruple helix stakeholders are considered. Depending on need, the technical office might also request on a temporary basis the participation of additional working group members.

FIGURE 2

Governance model, challenge of marine plastic debris



Source: Own elaboration, based on Fernández & Romagosa (2020).

5.2. Circular aquaculture

5.2.1. Context of the challenge

Aquaculture is the fastest-growing animal food-producing sector in the world with EU aquaculture production expected to reach roughly 1.7 Mtons in 2030, with a 28.8 % increase of around 370 ktons (FAO, 2018). Such growth, however, should be taken with care and directed towards sustainable, circular consumption and production patterns, in order to avoid the past failures of other industries.

Nowadays, the sustainable aquaculture industry is working for the emergence and diffusion of circular aquaculture practices, such as the development of Integrated Multi-Trophic Aquaculture (IMTA) or the upscaling of micro and macro-algae farming and exploitation that require technological innovation. However, these improvements on the production and technology side face obstacles beyond technology development. For instance, some of the main obstacles preventing the diffusion of circular aquaculture practices relate to aspects such as (EUMOFA, 2020; Francocci *et al.*, 2019):

- The need to balance sustainable aquaculture with other uses of maritime space such as tourism, in maritime spatial planning.
- Beyond maritime spatial planning, the limitations set by a regulatory framework inconsistent across sectors, countries, and governance levels.
- The limited provision of staff with specialised skills.
- The funding available to de-risk investments and promote market development.
- The social acceptance of new products, and currently limited efforts. to communicate these products.

5.2.2. Empirical cases of governance arrangements: B-Blue project, Submariner Network

Different multi-stakeholder initiatives have been launched to address these obstacles. In proposing a transnational Shared Agenda frameworks to address the challenge, the present paper draws inspiration from the cases of i) the B-Blue project, a network of living labs whereby regional and national stakeholder networks co-develop and test in real-life settings blue biotechnology innovations in the Mediterranean; ii) the Submariner Network, a multi-stakeholder and multi-project alliance promoting innovation cooperation around sustainable development challenges in the Baltic basin.

A part of the B-Blue project, a network of five blue biotechnology living labs has been established in five Mediterranean countries (Greece, France, Italy, Slovenia and Spain). Each of these living labs has gathered representatives of stakeholders such as companies, administration, research institutions and universities, environmental organisations, as well as society and end-users. These networks intend to develop value chains for the emergence of sustainable blue biotechnology innovations, in fields such as IMTA, the valorisation of aquaculture and fisheries discards, the development of high-value compounds from micro-algae production, or the use of microorganisms and ICT tools for marine environment restoration (Auregan *et al.*, 2020; Quero *et al.*, 2021).

Although mostly regional and national in nature, each of the living lab networks includes a guiding group of stakeholders, some of which possess relatively high expertise in the blue biotechnology field (Auregan *et al.*, 2020, p. 9). These actors can help the rest of the living lab community access resources (human, financial, or technological among other types) available at higher governance levels. Additionally, the structure of the project as a network of living labs also allows each of the regional/national living lab communities to diffuse local innovations to the other living labs (Quero *et al.*, 2021).

In sum, the B-Blue living labs can be seen as equivalent to the *innovation co-creation groups* proposed within the transnational Shared Agendas framework; their strong regional and national footing helps identify innovations useful to transform aquaculture towards sustainable production and consumption patterns, and the guiding stakeholder group might provide help diffuse these innovations. However, their regional and national linkages might still be too limited to ensure the diffusion of innovations, especially those of a more transformative nature -and thereby less likely to fit within the limits of socio-technical regimes-. These limitations might be compensated by the structure implemented by the Submariner Network (Schultz-Zehden *et al.*, 2021). Specifically, the day-to-day coordination of the network is led by a strong secretariat, akin to the technical office included in the transnational Shared Agendas framework. The secretariat actively carries out, with their own resources or the help of network stakeholders with expertise on the topic, a range of activities useful to innovation diffusion such as:

- Matchmaking events, whereby linkages are stimulated across a network of more than 1,700 institutions including companies, business support organisations, public authorities and research institutions. Out of these institutions, more than 650 companies work in fields closely related to circular aquaculture, such as algae production, blue biotechnology compounds or fish and mussel aquaculture (Schultz-Zehden *et al.*, 2021; p. 36).
- An accelerator programme, whereby mentoring and matchmaking services have been provided to more than 30 start-ups within blue biotechnology, and other blue economy fields (Schultz-Zehden *et al.*, 2021; p. 37).
- Access to public and private investors, also outside the network (Schultz-Zehden *et al.*, 2021; p. 43).

Additionally, some of the projects integrating the Submariner Network have helped the network promote a policy framework better suited to the upscaling of sustainable aquaculture, at the regional (S3) level and nationally.

Last but not least, the Submariner Network includes multi-stakeholder working groups in areas related to sustainable aquaculture such as Recirculating Aquaculture Systems, IMTA, aquaponics or mussel aquaculture. These thematic working groups intend to support their communities in the search for funding and investment opportunities, and policy influence activities destined to promote a more suited regulatory framework.

5.2.3. Proposed Shared Agendas framework

Together with the context of the challenge, the empirical cases of governance arrangements inform the transnational Shared Agendas framework (Figure 3) as follows:

Based on the example of the B-Blue project, the innovation co-creation groups are conceived as living labs whereby regional/national stakeholder networks experiment with innovation portfolios in real-life settings. Tapping on the multi-level linkages of some of living lab stakeholders, those innovations with relatively high diffusion potential are promoted in matchmaking events with the other innovation co-creation groups.

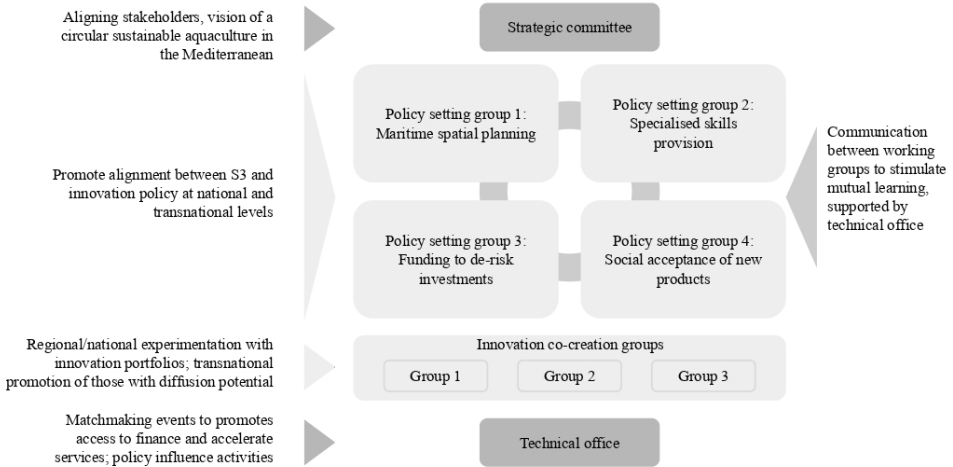
Drawing on the example of the Submariner Network, the technical office can support the scaling up of innovations with diffusion potential by involving the innovation co-creation groups in matchmaking events with stakeholders providing accelerator services, and external parties such as investment funds.

Also taking inspiration from the case of the Submariner Network, the technical office should help improve the influence of the policy setting groups. Organised around the main obstacles preventing the diffusion of circular aquaculture, these groups are tasked with the goal of improving policy alignment between S3 and other governance levels.

Based on their multi-level membership, both the policy setting and innovation co-creation groups are expected to be able to link developments at different governance levels, and they should also be able to coordinate actions among themselves. However the case of the Submariner Network points out to the need for a technical office with relatively strong coordinating capabilities, to ensure communication across working groups.

FIGURE 3

Example of a governance model, challenge of sustainable aquaculture



Source: Own elaboration, based on Fernández & Romagosa (2020).

6. Conclusions

New types of innovation policy are required to address, in the Mediterranean, sustainable development challenges related to the blue bioeconomy such as IMTA and micro/macro-algae farming and exploitation (EUMOFA, 2020; Francocci *et al.*, 2019); as well as threats to sustainable development in the blue bioeconomy such as marine plastic debris (Boucher & Billard, 2020; Miedzinski *et al.*, 2019). In order to address these and other blue bioeconomy challenges, innovation policies should be able to combine directionality, i.e. an emphasis in aligning innovation projects towards tackling the challenge, with room for experimentation with alternative types of innovations (Fitjar *et al.*, 2019; Mazzucato, 2016; Molas-Gallart *et al.*, 2021). Owing to the multi-faceted nature of the challenges, one-sided solutions do not suffice.

Inspired by a reformed S3 approach to innovation policy, the Shared Agendas framework (Ariño & Fernández, 2021; Fernández & Romagosa, 2020; Marinelli *et al.*, 2021), the present study proposes a transnational governance model of innovation policy aimed at addressing these challenges, while extending the practical applicability of the literature on the directionality of innovation policy (Fitjar *et al.*, 2019; Mazzucato, 2016; Schot & Steinmueller, 2018). Because societal stakeholders build a common narrative in Shared Agendas around the goal of tackling the challenge, a shared vision aligns their efforts, while also accommodating the inclusion of alternative solutions

to the challenge. Meanwhile, the working groups included in the governance model enable experimenting with alternative specialisation domains, while the technical office supports promotes mutual learning across them. The technical office, furthermore, should animate broad stakeholder involvement in the working groups.

Although largely regional in its foundation, an S3 approach like Shared Agendas can be readily extended to transnational, Mediterranean-wide challenges like those of the blue bioeconomy, promoting learning and coordination between networks of innovators, transnationally and across different levels of governance. The present article advances examples for two of these blue bioeconomy challenges, that are addressing plastic pollution in the Mediterranean, and promoting circular aquaculture.

The proposed transnational governance model departs from the original Shared Agendas framework in a number of ways; these modifications point towards a more complex range of interactions between the model's core components and working groups; interactions should also increase between the working groups, and within them:

- Both its nuclear components –the strategic committee and technical office– and its working groups –whether policy setting or innovation co-creation groups– have to be adapted to include members operating at the regional, national or transnational levels of governance, as well as in multiple countries.
- The design of the innovation co-creation groups as living labs with a strong regional/national footing –as in the B-Blue project– suggests a way for the governance model to identify innovations with transformative potential.
- As the case of the BlueMed Initiative suggests, government representatives' dual membership in the policy setting and innovation co-creation groups can support policy coordination at different governance levels and countries, facilitating the diffusion of transformative innovations. In doing so, government representatives fulfil innovation intermediary functions (Bessant & Rush, 1995; Howells, 2006), linking regional/national innovators with stakeholders able to support transnational upscaling.
- The case of the Submariner Network points out the need to ensure enough resources for the technical office to carry out innovation diffusion tasks in a transnational setting, with a broader variety of stakeholders than in a regional shared agenda. Following the case of the BlueMed Initiative, the participation of quadruple helix stakeholders in the technical office might ease part of this additional coordination burden, while increasing its potential as an innovation intermediary (Bessant & Rush, 1995; Howells, 2006).

In exchange for its additional complexity, however, the proposed transnational Shared Agendas model can deliver an increased ability to address blue bioeconomy sustainable development challenges in transnational, and multi-level settings like the Mediterranean. As pointed out by the transformative innovation policy literature (Molas-Gallart *et al.*, 2021; Ghosh *et al.*, 2021), the systemic nature of sustainable development challenges reinforces the need for coordinating innovative action beyond the limits of a region or country. By mobilising a broader range of actors and resources –whether market access, investments, policy influence or other–across the Mediterranean, it will be easier to upscale innovations addressing blue bioeconomy challenges like those covered in the present article. In turn, the inter-regional nature of the governance model allows to adapt innovations to the context of different regions (Fernández-Guerrero, 2020).

The foundations of the proposed governance model should also be easily adapted to the needs of the specific challenge. In particular, the flexible nature of the innovation co-creation groups enables rapid adaptation to opportunities emerging in the innovation landscape, increasing the capacity of the model to follow developments in connection with the challenge. Hence, although further research is required before fine-tuning the proposed Shared Agendas governance model, its design makes it a promising option for coordinating transnational innovation efforts in connection with the blue bioeconomy.

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Conflicts of interest

The authors notify no conflicts of interest, in connection with the present study.