



Exploring the contribution of multi-use approach in fostering local blue economy: Insights from the Global South

Sereno D. Diederichsen^{a,*}, Carlos V.C. Weiss^{a,b,**}, Francisco A.V. Lima^a, Bruno A.Q. dos Santos^a, Josselin Guyot-Téphany^c, Jean-Baptiste E. Thomas^d, Ivana Lukic^e, Céline Rebours^f, John Patrick Walsh^g, Jennifer McCann^g, Elea Juell-Skielse^d, Fredrik Gröndahl^d, Marinez E.G. Scherer^a

^a Laboratory of Integrated Coastal Zone Management, Federal University of Santa Catarina, Graduate Program in Geography, Campus Universitário Trindade, Caixa Postal 476, CEP 88.040 – 970, Florianópolis, SC, Brazil

^b IH Cantabria - Instituto de Hidráulica Ambiental de la Universidad de Cantabria, Santander, Spain

^c University of Nantes, France

^d KTH Royal Institute of Technology, Sweden

^e s.Pro – sustainable projects GmbH, Germany

^f Møreforskning AS, Norway

^g University of Rhode Island Coastal Resources Center and Rhode Island Sea Grant, USA

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ABSTRACT

Ocean Multi-use (MU) has gained significant attention as an approach with great potential to promote a more sustainable and space efficient Blue Economy development. Despite many efforts to implement the multi-use concept into practice, MU still has many practical challenges, which is even more evident outside the European context, where there is significant policy support for MU. This paper aims to elucidate how MU can bolster the local blue economy, particularly within the context of the Global South. The research is based on a case study in southern Brazil, within a traditional fishing community that occupies a marine protected area. A practical analysis of the synergies between community-based tourism, artisanal fishing and conservation was done through interviews with key stakeholders. The main benefits, constraints, opportunities, and risks of MU activities were identified. Results demonstrate the positive impact of MU promoting revenue, environmental education, and cultural and historical attributes. MU has shown great positive impact on social, economic, and environmental aspects within this case study. Key enabling factors that allowed the MU development were horizontal participatory governance and the protagonist of fishers. In terms of existing challenges, the absence of investment in infrastructure, fragmented governance and lack of institutional support was pointed out as the main constraint and limitations to strengthening MU. We argue that MU can be an important strategy for promoting the local blue economy. In the Global South context, the efficacy of MU initiatives appears intricately tied to the participation of local actors in a manner tailored to local contexts and challenges.

1. Introduction

The coastal zone and the oceans have great potential to support local economies (Katila et al., 2019). However, the blue economy continues to not fully include the needs of coastal communities and the promotion of local marine and coastal activities are often overlooked during planning processes (Bennett et al., 2022). The local blue economy (LBE) is a

concept that emphasizes the links of the local level of the Blue Economy, also associated with nearshore marine space (Setiyowati et al., 2022; Chen et al., 2020). This distinction is relevant because the LBE supports socio-cultural values, subsistence activities as well as a great diversity of other uses. However, LBE is still characterized by the struggle for space, conflicts, and human coast and oceanic impact (Bennett et al., 2022; Chen et al., 2020). In this same context, the ocean Multi-use (MU)

* Corresponding author. Federal University of Santa Catarina, Florianópolis, SC, Brasil.

** Corresponding author. IH Cantabria - Instituto de Hidráulica Ambiental de la Universidad de Cantabria, Santander, Spain.

E-mail addresses: sereno.diederichsen@gmail.com (S.D. Diederichsen), dacruzcv@unican.es (C.V.C. Weiss).

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concept aims to reduce competition for space by promoting spatial efficiency and synergies with a focus on the core sectors of the blue economy (Abhinav et al., 2020). Driven mainly by the rapid development of offshore renewable energies (Weiss et al., 2018a), ocean MU research generally addresses technical aspects of multipurpose platforms between aquaculture, wind, wave, and solar energy (Abhinav et al., 2020; Aryai et al., 2021; van den Burg et al., 2020). Offshore wind energy production and environmental protection in coastal waters (e.g., Kyriazi et al., 2015), spatial synergies between fish farming, wind, and wave energy (e.g., Weiss et al., 2018b, 2023), fishing tourism (e.g., Piasecki et al., 2016), tourism, renewable energy and the oil and gas industry (e.g., Depellegrin et al., 2019) are also examples of MU studies that consider the core sectors of blue growth.

The MU approach emerged from the search for sustainable alternatives of ocean exploitation with a predominant focus on promoting blue growth (Guyot-Téphany et al., 2024). The MU concept refers in general to the joint use of resources in close geographical proximity by one or multiple users (Schupp et al., 2019). The first scientific initiatives (e.g., Buck et al., 2004) and their inclusion in political agendas (Blue Growth Strategy, European Commission, 2012; Directive, 2014/89/EU on Maritime Spatial Planning, European Union, 2014; Blue Growth greening, European Commission, 2021) directed the development and application of MU to the main drivers of the blue economy (e.g., large-scale energy generation and food production; Weiss et al., 2018a, 2018c). Although the implementation of MU scenarios may help to achieve the United Nations Sustainable Development Goals (SDGs) and can be used as a tool within Marine Spatial Planning (MSP), the potential of this marine management tool is relatively unknown in LBEs, and it is still a conceptual approach with a clear gap between theory and practice (Guyot-Téphany et al., 2024). As such, there is a need for practical analysis of the benefits and challenges of implementing MU approaches.

Despite the burgeoning popularity of MU as a tool for efficient exploitation of the marine environment (Stancheva et al., 2022), its application is skewed towards the interest of “major blue growth players”. Furthermore, the development of the blue economy and the application of the MU approach presents a large number of uncertainties (Ciravegna et al., 2024), which may be even more evident in a Global South context, where democratic governments face numerous challenges (Gonçalves et al., 2021) and are characterized by fragmentation of policies, asymmetrical power relations in decision-making and reduced interaction with scientific institutions (Fearnside, 2016; Viola and Gonçalves, 2019).

To the author's knowledge, there is no study that specifically explores the participative MU planning process with a strong focus on local economies in the Global South. With this objective, this study was guided by the following research question: Could an approach developed for the blue economies of the Global North be applied to assist traditional coastal communities in ocean governance in the Global South? The authors hypothesize that a bottom-up approach can be useful to bring ocean MU to a practical level and develop methods to include blue economy development into local planning. Therefore, this study aims to understand how MU can contribute to the LBE, with special attention to the perspective of the Global South. The analysis was based on the application of the Multi-Use Assessment Approach (MUAA, McCann et al., 2023), developed within the framework of the MULTI-FRAME Project,¹ on a specific case study in southern Brazil. The MUAA was designed to serve as a guide for evaluating the potential of ocean multi-use as a tool to address specific planning challenges, particularly in balancing the use of ocean resources and space among different ocean users. With an understanding of the synergies between community-based tourism, artisanal fishing and conservation, a practical analysis of the opportunities of how MU can support the development of the LBE was evaluated.

2. Case study

The case study was developed in the Pirajubaé Marine Extractive Reserve (PMER, Fig. 1), a federal sustainable use² Marine Protected Area (MPA), established in 1992, and managed by Chico Mendes Institute for Biodiversity Conservation (ICMBio in Portuguese). The PMER covers 1.721 ha, including a mangrove area and its adjacent marine area, with the stated aim of protecting the livelihoods of a traditional coastal community and conserving its natural resources (Casagrande et al., 2021). Within the reserve only registered member fishers have the right to access available resources such as fish, shrimp and cockles. PMER members are divided into three categories of fishers: *i*) those who depend on fishing for their livelihood; *ii*) those who have fishing as an auxiliary source of income; and *iii*) those who use fishing as a cultural or recreational activity (Ribas and Zuculoto, 2012).

Since its establishment in 1992, there has been an increasing conflict between PMER's resource users making it difficult to fully achieve its goals. There are also conflicts between the PMER administration and other public organizations, mainly as a result of infrastructure projects and urban expansion (Spinola et al., 2014). This context has reinforced the marginalization of this fishing community and limited the recognition of PMERs members social-cultural relevance, which has led to an increase in social vulnerability (Vivacqua, 2018). To overcome these challenges, PMERs staff actions sought to promote better fishing practices and empower the local community. An important step in this direction was the creation of a deliberative council in 2010, which was constructed to create a space for debate with PMERs members and establish management strategies in a participatory manner. In 2015, a member of the fishing community introduced the community-based tourism (CBT) in the PMER with the main goal of improving the livelihoods of people in the fishing communities (Teixeira et al., 2019). Since then, the implementation of CBT has created several business opportunities for the community, such as the showcasing of traditional territorial knowledge, demonstration of fishing techniques and environmental education.

3. Material and methods

In the present case study, the MU takes place through the association between community-based tourism (CBT), artisanal fishing and conservation. The development of MU was evaluated through the MUAA (McCann et al., 2023), developed under the MULTI-FRAME project. The MUAA was developed to “increase the knowledge base and capacity of public and private actors for assessing ocean MU systems” (McCann et al., 2023). Based on this approach, a review was conducted to understand the establishment of MU, as well as a survey of the stakeholders involved.

In the case study, all the key stakeholders involved in the three activities were identified and a stakeholder analysis was conducted to understand the governance structure and the role and commitment of the stakeholders in implementing the MU case. Also, a PESTEL (Political, Economic, Social, Technological, Environmental and Legal) analysis was conducted to understand the aspects of MU in the study area (Rothaermel, 2014). This analysis provides an understanding of different external factors that impact the MU development (Rothaermel, 2014). A first version of the analysis produced a PESTEL table that served as the baseline to develop a semi-structured interview guide. The results of the interviews were then analyzed using NVivo software and validated in a workshop with stakeholders to identify opportunities, benefits, risks, and constraints, as well as to produce and validate a second PESTEL table. Possible solutions and enabling conditions were

¹ <https://www.submariner-network.eu/multi-frame>.

² The Law 9.985/2000 sets up the National System of Conservation Units, in which federal sustainable use is a class of Protected Area focused on the conservation of natural resources and the sustainable use of such resources.

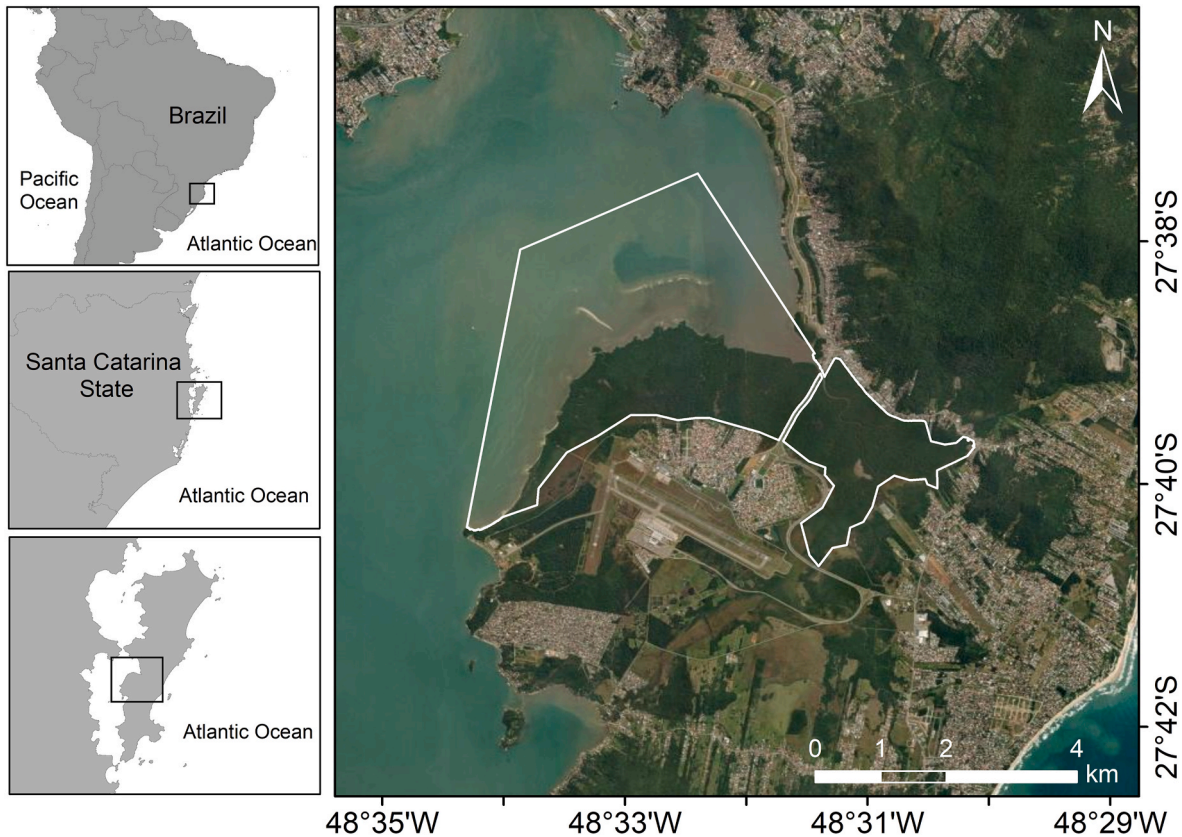


Fig. 1. Pirajubaé Marine Extractive Reserve (PMER) location (white polygon), in Florianópolis - State of Santa Catarina. Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

obtained in this process to identify strategies and obstacles to assess the feasibility of implementing the MU strategy, along with the recommended actions (Fig. 2).

3.1. Stakeholder analysis and governance structure

The existing governance structure and favorable conditions for the development of a MU were assessed. The stakeholders' identification was based on their relevance in the specific context of PMER, through

recommendations from PMER members and research institutions (McCann et al., 2023). Based on their interests, stakeholders were divided into two groups: i) the Core Collaborators (CC) and; ii) Secondary Collaborators (SC). CC are individuals who represent organizations that will be directly impacted by MU development and implementation. SC are individuals who represent organizations that may experience an indirect impact of the MU system and/or could contribute expertise and resources.

Through consultations and reviews of the attributions and

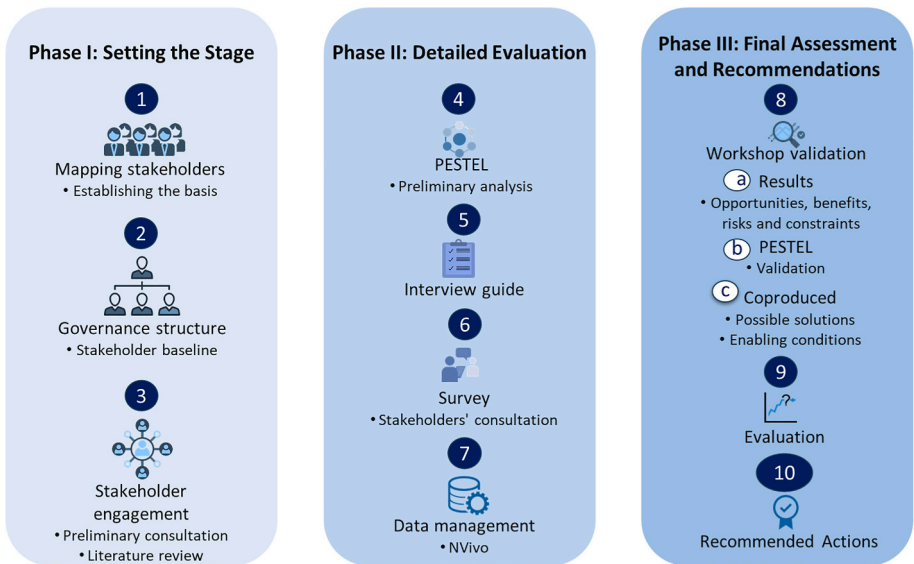


Fig. 2. Methodological steps flowchart, with key MUAA aspects.

engagement of each mapped stakeholder, a table was created containing: *i)* the interests and resources for the MU scenario; *ii)* categorization of power, and *iii)* description of the interrelationships using an actor-linkage matrix. The social and historical context of involvement in which the stakeholders operate were also considered, which indicates whether or not there is trust between them. Stakeholders descriptions were plotted on power versus interest grid, according to their relative power in terms of MU-related development and decision situations and their relative interest in MU.

- The key players (high power and high interest) consist of the authorities who have the principal decision-making roles.
- The context setters (high power, low interest) are privileged actors in the sense that they may be able to influence decision-making without necessarily being involved or interested in MU developments.
- The subjects (low power, high interest) are the various sectors engaged in- or prospecting for marine space utilization.
- The crowd (low power, low interest) consists of actor groups that are neither directly involved in nor may have much interest in the present case's MU.

The interrelationships between all stakeholders were identified through an Actor-linkage matrix using three types of classification: *i)* Collaborative (good relations of collaboration); *ii)* Neutral (more or less neutral relations with potential for compatible relations); and *iii)* Conflicting (poor relations).

3.2. Interviews

The interviews were conducted both in-person and online, depending on availability. The consent of all interviewees was obtained before beginning, and all individuals were treated anonymously. First, the level of knowledge and/or experience of the interviewee pertaining to the concept of MU was assessed. Subsequently, the study and project were presented to the participants using a short presentation of the objectives and purpose of the research. Based on the understanding of the participant about the MU approach, the interviewee was asked to respond to questions related to two of the six PESTEL Aspects, selected by them (i. e., relating to Political, Economic, Social, Technological, Environmental or Legal aspects of the MU case; Rothaermel, 2014). This strategy was designed to delve deeper into topics the interviewee found relevant or had greater expertise in.

For each PESTEL aspect, each interview covered the main topics: *i)* positive and negative impact of MU; *ii)* critical elements for MU development; *iii)* areas of greatest interest and in-depth knowledge and; *iv)* synergies and relationships among stakeholders.

Interview transcripts were analyzed using Nvivo software, which facilitates ways of connecting parts of the dataset by integrating different aspects of reflection (Wong, 2008). This analysis allows moving beyond a rigid division of categories to a broader interpretation canvas (Allsop et al., 2022). The Nvivo analysis categorized answers using keywords, phrases and/or core message, and served to visualize data and further classify the data according to: *i)* Impact of MU within positive, neutral and negative categories; *ii)* Development of MU into facilitators, prerequisites and hurdles categories (Edwards-Jones, 2014).

3.3. Validation of results and final assessment

To validate and discuss the information obtained in the interviews and previous stages, a workshop was organized with all the key stakeholders identified in this study. The event lasted 3 h and was divided into three stages: *i)* The preliminary results obtained were presented; *ii)* Participants validated PESTEL data key information; *iii)* Participants discussed, adjusted, and validated the main results. The discussion focused on the opportunities, benefits, risks, and constraints with

regards to broader themes of safety, environmental, economic, and legal/regulatory aspects identified in the interviews. Within this context, therefore, opportunities are defined as relating to the possible chances for advancement or improvements in terms of these themes; benefits include specific experienced advantages; risks, if mentioned, are factors that may prevent or impede the implementation of MU; and constraints are the conditions that frame the application of MU (e.g., regulatory framework).

Actions to overcome constraints and risks and/or take advantage of benefits and opportunities (i.e., possible solutions) were identified with the collaboration of participants. In addition, it was determined whether this effort had the enabling conditions to advance MU or whether another ocean planning approach needed to be considered (Olsen, 2003; Olsen et al., 2011). Finally, in the last stage of the MUAA, the next steps and strategies to take the process forward were identified, highlighting the challenges and future actions.

4. Results

The results are structured according to the methodological procedures. First, stakeholder identification is presented along with the MU scenario and the findings in terms of Benefits, Opportunities, Risks, and Constraints. Next, PESTEL analysis are explored outlying the main factors related to the impact and development of MU.

4.1. Stakeholders identification and governance structure

A total of nine groups of stakeholders were identified and divided into the two analyzed groups. CC: Pirajubaé Beauties Community Tourism Project - PCP; Chico Mendes Institute for Biodiversity Conservation - ICMBio; Island UC Collective Association - Island UC. SC: Federal Institute of Santa Catarina - FISC; Federal University of Santa Catarina - FUSC; Municipal Aquaculture and Fisheries Secretariat - MAFS; Santa Catarina Secretariat of Agriculture and Fisheries - SCAF.

In this case study, the horizontal participatory design and governance structure was one of the reasons for the success of CBT. This is explained by how PMERs Deliberative Council is designed. Within the council, CBT activities were developed with the participation of community representatives, PMER members, and the support of ICMBio and Island UC. This group of organizations has supported CBT activities, evaluation, and its effectiveness and the achievement of its objectives.

Fig. 3 shows the analysis of power and interest of the stakeholders, and both PCP and ICMBio have a leading position, while several other organizations such as the Island UC were evaluated to have high interest but relatively little power. In contrast, a few institutions with an important role in promoting MU were ranked as having little interest, such as the MAFS and SCAF. FISC and Island UC were plotted as institutions that have given great support to the development of CBT, but they have minimal power to promote MU in the case study regional context.

4.2. Multi-use scenario evaluation

Based on a previous classification, the type of the potential MU in the study area can be defined as symbiotic use³ (cf., Schupp et al., 2019) since there is no direct linkage of one core function to the other. In this type of MU, there is a connection through provision services, such as docks and, reflecting a level of commitment between users. Among the organizations that participate in CBT governance, MU is not understood

³ Schupp et al. (2019) classify MU into four types: 1) Multi-purpose, 2) Symbiotic, 3) Co-existence, and 4) Subsequent use. Generally, type 1 represents the highest level of synergy and interaction between uses, while type 4 involves the least. Differentiation is based on four dimensions: Spatial, Temporal, Provisioning and Functional.

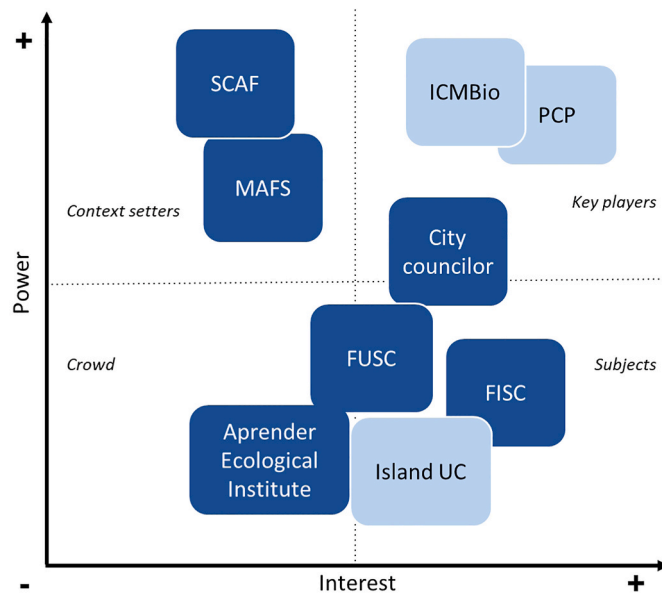


Fig. 3. Power versus interest grid - Stakeholders were divided in four groups: Key players, context setters, crowd and subjects. Also, stakeholders are divided into Core Collaborators (CC) in light blue and Secondary Collaborators (SC) in dark blue. Abbreviations: Pirajubáe Beauties Community Tourism Project - PCP; Chico Mendes Institute for Biodiversity Conservation - ICMBio; Island UC Collective Association - Island UC; Federal Institute of Santa Catarina - FISC; Federal University of Santa Catarina - FUSC; Municipal Aquaculture and Fisheries Secretariat - MAFS; Santa Catarina Secretariat of Agriculture and Fisheries - SCAF. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

as a limiting factor for the other activities because the activities are dynamic and do not depend on each other for operation. The understanding among stakeholders is that the MU should continue as a symbiotic use for its best functionality and operation.

The integration between fishing, conservation and tourism is through collaboration, with no compromise of their activity. As example, one of the interviewees pointed out: *“The MU activity is carried out by experienced fishermen, who understand the natural environment and the existing uses”*. Also, fishing practices are brought into the tourism activity, according to the fishers’ availability and interest. In addition, tourism activity gives support to the sale of goods. Both stakeholders benefit from MU. The MU also benefits economically vulnerable populations. Since these populations depend in many cases directly on marine and coastal resources, tourism activity allows an additional source of income, thus improving the livelihood of these populations. Furthermore, all activities respect PMER’s rules of use for the environment conservation and its resources.

4.3. Benefits, opportunities, risks, and constraints

Although the MU is still in its early developmental stages in this case study, it already demonstrates important benefits for stakeholders. For the fishers it has the potential to diversify and bring regularity to their income, notably given that summer is a low season for some fishers and the high season for tourism. This MU activity promulgates the local fishers’ way of life, enabling them to share their practices, knowledge of the PMER, local history and culture, and interactions with the environment. One of the CC supported this perspective: *“This collective is intended to be associated with fishing activities, benefiting and promoting various skills and knowledge in the community”*. The dissemination of such environmental knowledge and ocean literacy is a key aim of this MU activity, as is providing tourists firsthand experiences of the benefits of coastal and marine conservation.

The results highlight key opportunities in the potential advancement in operational and safety concerns, such as improving infrastructure and facilities, and adapting fishing boats to be used in tourism activity. The activity could contribute to making traditional fishing “trendier” – resulting in better inclusion of young people in the fishing community. Integration of fisheries, marine conservation and tourism is seen also as an opportunity to enhance dialog between marine users. Also, this growth could also improve communication between public organizations, which could have a strong impact on access to boats and driver licenses, and infrastructure for boarding and onboarding boats, which is a current risk for the visitors.

The main constraints are associated with the seasonality of the activities, lack of institutional support, and the economic vulnerability of fishers. These factors limit the frequency and regularity of visits, resulting in a significant impact on the income from the activity. In terms of environmental aspects, with the possibility of an increase in the number of visitors, natural areas could be at greater risk of direct impact (e.g., visitors walking on cockle banks or mangrove areas) or suffer from additional environmental pressures from the increased activity (e.g., pollution from boats or increased sewage loads). To contain these impacts, collaborative work with PMER technicians has been assessing the development of activities.

4.4. Impact and development of multi-use

The impact and development of MU have proven to have a positive influence on the LBE, as shown by the number, size and distribution of positive aspects in Fig. 4, with many relating to environmental and social aspects (See also Table 1 for examples). From seven interviews, 16 positive social aspects were identified, including promotion of cultural identity, well-being, empowerment, and enhancing the fisher’s protagonism. 12 environmental aspects were identified by five interviewees encompassing environmental literacy, biodiversity restoration, and a decrease in pressures on marine biota. In terms of economic impact, four interviewees indicated seven positive aspects, especially regarding extra income to fishers’ families generated by CBT (Table 1). Important negative impacts were also identified, relating to a lack of investment in equipment (e.g., life jackets and safety accessories), which the MU developers (Pirajubáe Beauties Community Tourism Project) are responsible for.

Fig. 4 also presents the number of facilitators, prerequisites and hurdles affecting the development of MU in the PMER. In terms of facilitators, political aspects had the most mentions, notably regarding the existing political support and a favorable context for the MU establishment. The interviewees indicated a social interest in the MU within the political structure, especially among the members of the PMER’s deliberative council (Table 1). Legal and economic aspects also played a relevant role. It was indicated by interviewees that MU has promoted the community identity and self-determination. Also, the development of a bill in the city that incentivizes CBT can promote MU even more.⁴ The support of educational institutions has also allowed MU activities to be better designed and adapted to the local context.

The prerequisites identified are mainly linked to political and legal advances. Interviewees highlighted the existence of regulations that allow tourist activity in association with fishing, as well the existence of good coordination and social participation within PMER’s governance. The social aspects were associated with the protagonism and networking of local actors, which were also pointed out as a determining factor for the progress of MU.

The principal hurdles that were identified relate to political, legal, social, and economic aspects. The overall perspective was that there are still many conflicts, limited trust, and a lack of collaboration between

⁴ Available at: <https://www.cmf.sc.gov.br/proposicoes/Projetos-de-Leis-ordinarias/2021/1/0/64287>.

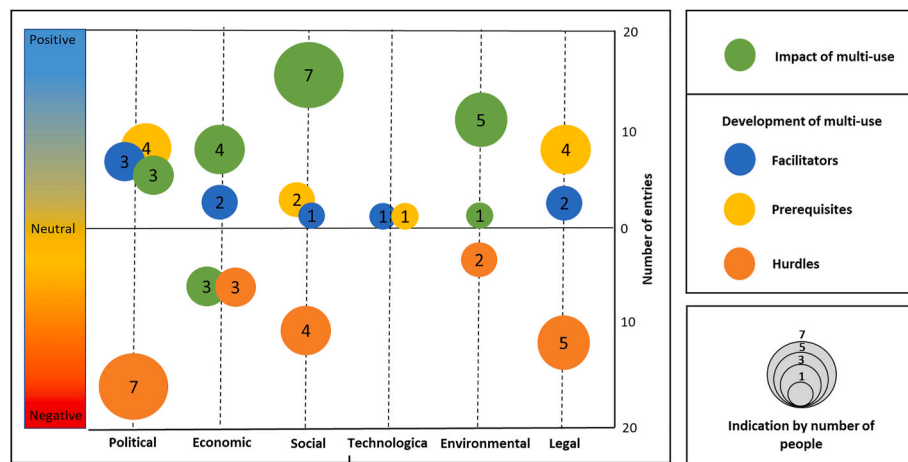


Fig. 4. Overall perspective of the impact and development of multi-use (MU). Positive, neutral, and negative impact linked to MU development in the case study. The presentation is based on the number of entries from interviewees' answers divided into positive, neutral, and negative (y-axis), and the six PESTEL aspects (x-axis).

government institutions and local stakeholders. Limited financial resources were another key hurdle, resulting in a lack of investment in new technologies, practices, and capacity building. For example, one interviewee pointed out that “MU could better integrate fisher’s territorial knowledge and fishing practices”. Finally, as prerequisites to CBT and MU activity, the stakeholders indicated the necessity of technical support, and funding from institutions to upgrade fishers’ boats and safety equipment for tourists. As mentioned by one of the Core Collaborators, “... the frequency of visits, financial support and marine infrastructure (docks) would be very beneficial to increase economic gains”.

4.5. Possible solutions and enable conditions

The need to improve infrastructure was pointed out in the results validation workshop as the most crucial action to promote the success of MU in the case study. It was indicated that initiatives aimed at overcoming the low number of visitors have often come up against infrastructure issues. Specifically, the main justification is the existence of inappropriate docks for tourists, which greatly limits the conditions under which tourist activities can take place, thus the numbers of visitors.

In addition to investment in infrastructure, another identified solution lay in the enhancement of institutional dialog. Given the difficulty in obtaining licenses to facilitate interventions in the docks, the dialog between government institutions seems to be a necessity moving forward with MU activities.

In the last two years the inconsistency in the number of visitors has received most of the concern. Some of the proposals to increase the number of visitors were: promotion through social media, flyers, partnership with other organizations. These proposals had good short-term results. For the bureaucracy and cost of acquiring tourism boats and drivers’ licenses, partnership was one of the key strategies implemented. With the support of educational and government organizations, CBT developers aim to establish a roadmap for license acquisition, in which all documents and procedures would be prepared. This strategy facilitates the inclusion of new fishers into tourism activities.

5. Discussion

MU is a novel concept in the blue realm with a strong background from European countries (Guyot-Téphany et al., 2024; Rezaei et al., 2024). Its benefits are still debatable and with little knowledge from other global contexts. The case study presented here demonstrates that MU can have a great impact on LBE and other valuable aspects, especially when MU activities are designed with local stakeholders and

considering socio-economic and environmental factors. The diversification of fishing community activities has been recognized in the literature as an economic promotion strategy (Kyvelou and Ierapetritis, 2020). The results showed the positive impact of MU in terms of local social, economic and environmental aspects. In this case study, MU presents economic opportunities to local fishers, also sharing their territorial knowledge and practices. Also, MU main constraint is linked to lack of investment in infrastructure, which reduces the operational capacity and consolidation of the MU. Other constraints identified were political and legal aspects, which have already been recognized in the context of the MU as a driver of the blue economy (cf., Depellegrin et al., 2019; Van den Burg et al., 2019). In this case study, the lack of a legal basis to support MU and the existing short-term policies have limited MU development. Strategies to overcome the challenges encompass institutional partnership and dialog. Also, there is a lack of public participation and capacity building, which can mobilize local resource users’ knowledge, as also noticed by Bennett et al. (2022).

The analysis of MU literature reveals that it is grounded in the concepts of Marine Protected Areas and Marine Spatial Planning (Guyot-Téphany et al., 2024; Weiss et al., 2023; Schupp et al., 2019). However, MU seems to be a technical management solution, focused on functional integration driven by economic interests, with less social reflection or debate (Guyot-Téphany et al., 2024). Governance analysis in the MU context still has a long way to go, particularly regarding the relationship between emerging and traditional sectors. This case study highlights an intriguing governance scenario. While PMER’s horizontal governance enabled fishers to initiate the , its success has been hindered by weak integration and limited institutional support from other government bodies.

This research illustrates several challenges associated with Global South issues (Fearnside, 2016; Viola and Gonçalves, 2019). These include the poverty faced by local communities, including artisanal fishers, as well as the drivers of pressure and management constraints within protected areas (Fearnside, 2016). For the Global South, the MU approach offers a technical, operational framework for enhancing LBE while addressing the needs and challenges of involved groups. The results demonstrate that the MU approach can boost income for this vulnerable group, enabling them to sustain fishing, promote cultural visibility, enhance environmental education, and preserve coastal natural resources. Although the MU concept already includes social and environmental aspects, these are often overlooked in practice (Guyot-Téphany et al., 2024).

From a more general perspective, also including the Global North, this study indicates the benefits of deeper understanding of the social and environmental contexts for MU development. Through qualitative

Table 1
Second PESTEL table.

PESTEL Aspects	Themes	Explanations
Politics	1 Social interest	There is a good understanding and agreement of MU activities among participants.
	2 Dispute among users	Based on competition for space, different fishers could limit MU activities or influence PMER's decision-making.
	3 Coordination	MU is managed and coordinated with the direct participation of different stakeholders.
Economics	1 Economic benefit	MU is designed to provide economic benefit to fishers and their community.
	2 Identity	Promote fishing activities within the fisher's community, which support fisher's identity.
	3 Self-determination	Promote better decision making within fishing activities. Increase economic opportunities.
	4 Extra income	MU provides direct extra income for fishers.
Social	1 Social interest	Fishers are interested in MU activities, even if the benefits are not fully understood by them.
	2 Extra income	The extra income helps fishers by reducing the need to seek out fish.
	3 Identity	MU activity values the fishers and their knowledge and practice.
	4 Territorial comprehension	MU activity promotes the fishermen's spatial knowledge and understanding, as well as the stories and processes of transformation of their living spaces.
Technology	1 Infrastructure	There is a great need to improve the existing infrastructure, specifically the boat docks and the visitors center.
Environment	1 Natural resources conservation	MU can reduce the impact or the demand for natural resources.
	2 Ocean literacy	MU activities contribute to the understanding of marine and coastal ecosystems to society, which was identified as a specific need in the surroundings of the PMERs.
	3 Territorial comprehension	MU activities promote the understanding of natural areas, existing species and historical natural dynamics.
Legal	1 Establishment of MU norms	Based on the current uses and needs of the MU, it is necessary to establish rules for the use of spaces among users.
	2 Compliance of regulations	There is a need to follow up and monitor the compliance of MU activities, as well as those of other users.

Abbreviations: Pirajubaé Marine Extractive Reserve - PMER, Multi-use – MU.

research, this study highlighted the interaction between social and environmental aspects in shaping fishermen's relationships with their territory. This proved to be a relevant aspect for promoting LBE.

The limitations of the MU case study are associated with fragmented governance and lack of institutional support, including difficulties in obtaining licenses. This situation is in line with the main drivers of the blue economy in the European Seas (e.g., lack of a policy framework to guide licensing procedures; [Stuiver et al., 2016](#)). Following the perspective from Europe, MU implementation has been possible based on public funding ([Ramos et al., 2022](#); [Schupp et al., 2019](#)). This is also critical in the Global South context, where MU development requires investment in capacity building and integration between governmental institutions. While MU's success in this case study is tied to strengthening the capacities of PMER members, significant gaps remain in

understanding human activities within marine spaces and the potential for beneficial integration and synergies across sectors.

Owing to this study being carried out during the COVID pandemic, it was only possible to engage with a limited number of stakeholders from institutions involved in the development of CBT in the study area. In line with the global context, the results should thus be considered as making a limited contribution to recognizing the benefits of MU for the environment ([Guyot-Téphany et al., 2024](#)). However, the environmental educational and oceanic literacy activities that exist in the study area appear to be fundamental to a social understanding and valuing fishing communities, their ways of life and territory.

MU is a concept driven by growing interest in integration of economic activities in the ocean ([Schupp et al., 2019](#)). Still, the limited understanding of its benefits and possible changing patterns of ocean use have left questions about its positive effects. This study suggests that MU has great potential to promote LBE, specifically if MU development includes local characteristics and assists local resource users. In the present case study, key aspects for MU success are linked to the governance structure and fisher's role. Thus, the results indicate that an inclusion of local resource users' needs and governance challenges are key aspects to LBE development, and that the MU approach can be a stepping stone towards achieving this. In the perspective of the rapid change of coastal and marine environment in the Global South, supporting local stakeholders' integration, promoting their capacity and self-determination are key to the success of MU development and the Blue Economy sustainability.

6. Concluding remarks

This study supports the argument that alternatives for developing the LBE should not only focus on economic aspects but also include the socio-cultural and spatial attributes of marine uses. The present results indicate that MU can be an effective approach in dealing with some of the current challenges facing the local economies in Brazil, and also applicable across the Global South. While modest in scope, the case study demonstrates the potential of the MU concept to enhance synergies between sectors of the LBE, as well as the advantages of participatory processes in addressing the functional aspects of these sectors.

In terms of implementing and advancing MU, this case study exemplifies difficulties and hurdles already known in the literature, such as legal and political aspects, investment, and the demonstration of benefits to the environment. At the same time, the findings highlight the contributions of MU, such as decreasing the economic vulnerabilities, promoting ocean literacy valuing fishers, their territorial knowledge, practices, and backgrounds.

The development of the MU emerged from fisher's internal initiative to seek out new opportunities. This was only possible due to the progress and improvement of PMER's governance, which allowed fishers to be included in the proposition of management measures. Another determining factor in the development of the MU was the support of non-governmental organizations and research and educational institutions, whose support helped diminish the significance of legal and political challenges in establishing the MU. These stakeholders have also made important contributions to ensuring tourism activity develops following the PMER's social, environmental, and historical characteristics. All these considerations suggest the relevance of bottom-up MU initiatives. These conditions that facilitated the development of the MU highlight the long-term advantages of participatory governance initiatives, in which options for improving the fisher's activities were designed and established in collaboration with the various types of knowledge present.

To advance the MU field, some of the key research issues identified were: *i*) investigating marine governance mechanisms; *ii*) the existence and needs for capacity building of marine users; *iii*) exploring the potential for implementing MU strategies in a wide range of marine and coastal sectors. The MU is a concept that is still in its inception, so its

inclusion in Marine Spatial Planning and Coastal Zone Management processes, with a wide-ranging debate, will help to identify its main contributions, as well to promote the legal aspects, so that this strategy can be a powerful instrument for promoting a sustainable blue economy.

CRediT authorship contribution statement

Sereno D. Diederichsen: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Carlos V.C. Weiss:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Francisco A.V. Lima:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Bruno A.Q. dos Santos:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Josselin Guyot-Téphany:** Writing – review & editing, Validation, Methodology, Investigation, Formal analysis, Data curation. **Jean-Baptiste E. Thomas:** Writing – review & editing, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Ivana Lukic:** Writing – review & editing, Visualization, Supervision, Software, Resources, Project administration, Methodology, Formal analysis. **Céline Rebours:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **John Patrick Walsh:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jennifer McCann:** Writing – review & editing, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Elea Juell-Skielse:** Writing – review & editing, Visualization, Validation, Methodology, Investigation, Data curation, Conceptualization. **Fredrik Gröndahl:** Writing – review & editing, Visualization, Supervision, Formal analysis, Conceptualization. **Marine E.G. Scherer:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Formal analysis, Conceptualization.

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Declaration of competing interest

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Data availability

Data will be made available on request.

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