**Session:** *519 - Perspectives on assessing cumulative impacts in the Global South*

**Title:** *PMAIS: Critical Assessment of Synergistic Impacts in the O&G Industry.*

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**Abstract**

The Macrorregional Plan for the Management of Synergistic Impacts of Maritime O&G Production and Transportation Activities represents a new approach developed by Brazilian Institute of Environment and Renewable Natural Resources since 2019, in coordination with O&G operationalcompanies and implementing entities in federal environmental licensing. In its implementation phase, integrates actions of identification, georeferencing, monitoring, assessment, communication, and mitigation of socio-environmental impacts in five Brazilian states. Furthermore, the program is structured into 13 programs distributed across three conceptual axes the plan highlights the Macrorregional Program for Socio-Environmental Impact ssessment (PMAIS), responsible for the critical interpretation of indicators which are calculated by the characterization programs, correlating those with the observed phenomena and complementary data, to analyze cumulative socio-environmental impacts of the O&G production and transportation chain. In addition, PMAIS's main product is the Socioeconomic Yearbooks, which analyzes the dynamics of the O&G industry, enabling the understanding of territorial variations through conceptual and methodological references. The analysis is supported by the Socioeconomic Database, which ensures standardized integration of data. In the program, this methodological architecture, combined with interinstitutional governance, strengthens analytical capacity, the transparency on decisions-making, and the integrated environmental governance, contributing to more effective mitigation actions

**Abstract (in Portuguese)**

O Plano Macrorregional para a Gestão dos Impactos Sinérgicos das Atividades de Produção e Transporte de Petróleo e Gás Marítimas representa uma nova abordagem desenvolvida pelo Instituto Brasileiro de Meio Ambiente e Recursos Naturais Renováveis desde 2019, em coordenação com empresas operacionais de petróleo e gás e entidades implementadoras de licenciamento ambiental federal. Em sua fase de implementação, integra ações de identificação, georreferenciação, monitoramento, avaliação, comunicação e mitigação de impactos socioambientais em cinco estados brasileiros. Além disso, o programa é estruturado em 13 programas distribuídos em três eixos conceituais. O plano destaca o Programa Macrorregional de Avaliação de Impacto Socioambiental (PMAIS), responsável pela interpretação crítica dos indicadores calculados pelos programas de caracterização, correlacionando-os com os fenômenos observados e dados complementares, para analisar os impactos socioambientais cumulativos da cadeia de produção e transporte de óleo e gás natural. Além disso, o principal produto do PMAIS são os Anuários Socioeconômicos, que

analisam a dinâmica da indústria de petróleo e gás, permitindo a compreensão das variações territoriais por meio de referências conceituais e metodológicas. A análise é apoiada pelo Banco de Dados Socioeconômico, que garante a integração padronizada dos dados. No programa, essa arquitetura metodológica, combinada com a governança interinstitucional, fortalece a capacidade analítica, a transparência na tomada de decisões e a governança ambiental integrada, contribuindo para ações de mitigação mais eficazes.

## 1. Introduction

In the Brazilian economic and energy context, the oil and natural gas (O&G) sector has strategic relevance. The installation of offshore enterprises, aimed at hydrocarbon exploration, although aimed at socioeconomic development, are entropic by nature.

To balance economic development and environmental preservation, the Environmental Impact Assessment (EIA) is the main methodological instrument used by Brazilian environmental agencies to issue licenses. However, the EIA is applied in isolation, focusing on the analysis of each project, which limits the integrated assessment of multiple events and the cumulative impacts resulting from the concentration of offshore projects along the Brazilian coast.

To address these limitations, the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), proposed, in 2019, the Macro-regional Plan for the Management of the Synergistic Impacts of Offshore Oil and Gas Production and Transportation Activities, referred to as the Macro Plan. This plan is characterized as a master plan that aims to transform environmental licensing into a continuous management process led by IBAMA, in conjunction with other entities and with the participation of O&G operators.

The strategy aims to identify socio-environmental impacts of the O&G industry through integrated data analysis, supporting decision-making processes, linked to environmental licensing conducted by IBAMA. According to IN No. 14/2023 (Coprod/CGMac/Dilic), the central objective is to:

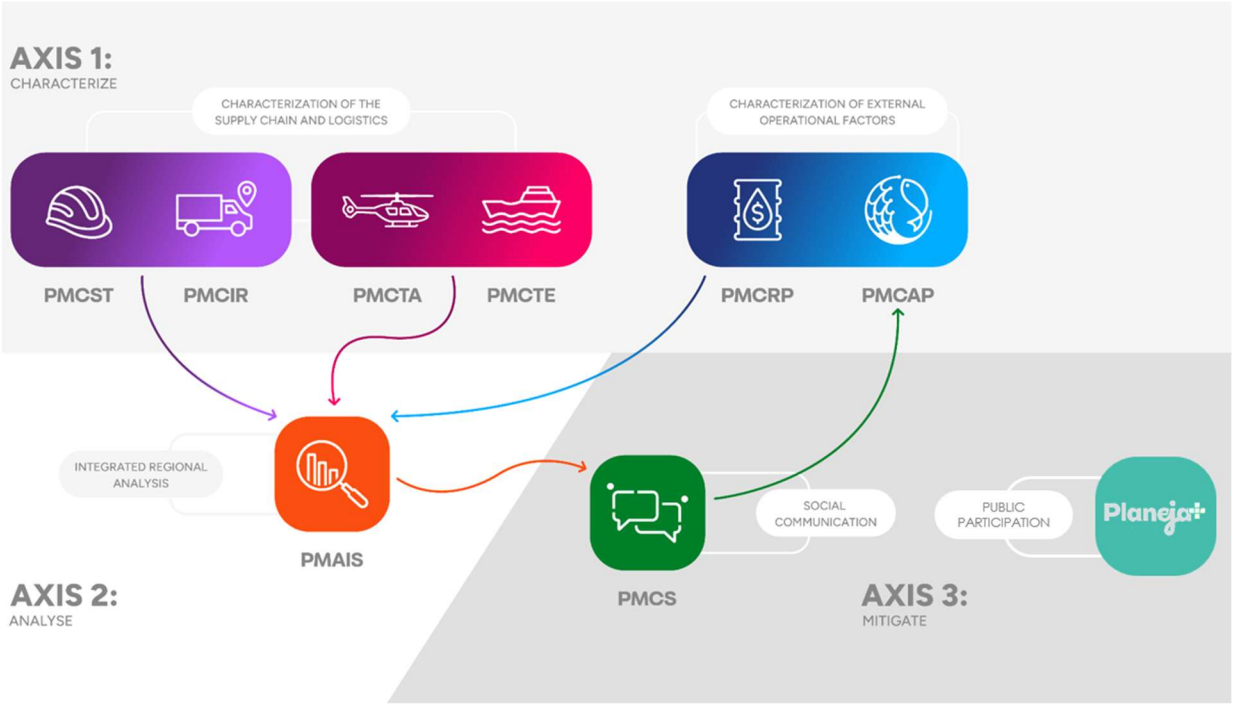
> *"promote the operational integration and administration of procedures for identification, georeferencing, monitoring, evaluation and mitigation of socio-environmental impacts in the region covered by the geographical limits of the Santos, Campos and Espírito Santo basins, and by the terrestrial limits of the set of areas of influence of the activities licensed by Ibama in these basins"*

To achieve this objective, the Macro Plan was structured into programs distributed across three conceptual axes: (i) characterization, (ii) analysis, and (iii) mitigation (see Figure 1).

This article highlights the Macro-regional Program for Socio-Environmental Impact Assessment (PMAIS), which is part of axis 2, the analytical axis of the Macro Plan. PMAIS is responsible for the critical interpretation and integrated analysis of the indicators monitored by the characterization axis 1 programs, together with complementary sources of information.

PMAIS seeks to correlate data from offshore activities in the O&G industry with complementary data, to analyze the cumulative socio-environmental impacts associated with the supply chain, logistics, receipt of oil revenues and fishing activities. The program is currently in the implementation phase. In its first year, activities included planning, conducting bibliometric research to identify theoretical-conceptual references on cumulative and synergistic impacts in the socioeconomic environment, and initial tests for collecting complementary socioeconomic data from municipalities located within the operational area of the Macro Plan. These data are intended to be correlated with characterization data of phenomena monitored in axis 1.

**Figure 1 - Macro Plan Programs and Axes**




## 2. Methodology

In the first year of implementation, the PMAIS focused on defining and adapting the concepts of cumulative and synergistic impacts to the institutional and regional contexts of the Macro Plan.

From an institutional perspective, the actions included planning implementation activities, conducting bibliometric research on cumulative impact assessment studies, proposing conceptual frameworks to support stakeholder discussions, and structuring a research plan aimed at understanding the dynamics of the O&G industry within the scope of the Macro Plan.

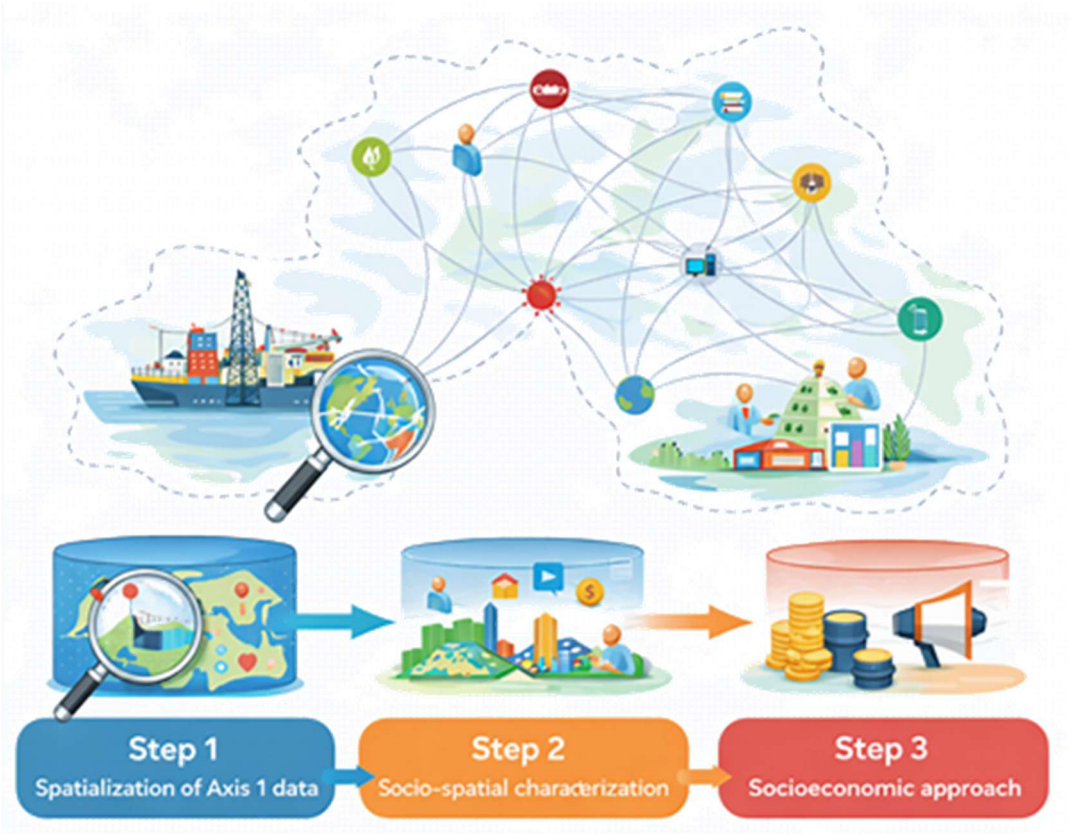
In the regional dimension, surveys of spatial data related to projects installed in the Santos, Campos, and Espírito Santo basins were initiated. These data were entered into the Socioeconomic Database (BDS), an instrument designed to support the execution of the Macro Plan. The BDS consists of a georeferenced computational structure programmed to

receive spatialized data. In parallel, workshops with stakeholders were conducted to define a value chain model of the O&G industry adapted to the operational context of the Macro Plan.

In the future, the integration of the value chain model with georeferenced data will enable spatial identification of projects and the delimitation of control areas for analyzing cumulative and synergistic impacts on the socioeconomic environment of the regions where PMAIS operates.

The methodological proposal of the PMAIS, for integrated data analysis, is organized in three stages: i. Spatialization of data from axis 1; ii. socio-spatial characterization of the region where the Macro Plan operates; and iii. Application of a socioeconomic analytical approach to data (see Figure 2).

**Figure 2 - Methodological proposal for integrated data analysis**




The integrated analysis seeks to structure a methodological approach that articulates the concepts of cumulative and synergistic impacts defined together with stakeholders. This approach is based on spatialization guided by the understanding of the O&G industry's value chain, studies of territorial interdependencies and productive dynamics to be identified over the next few years.

Within this organizational framework, PMAIS intends to develop processes for integrated analysis of social, economic, and environmental impacts. These processes will incorporate characterization data and complementary information from municipalities

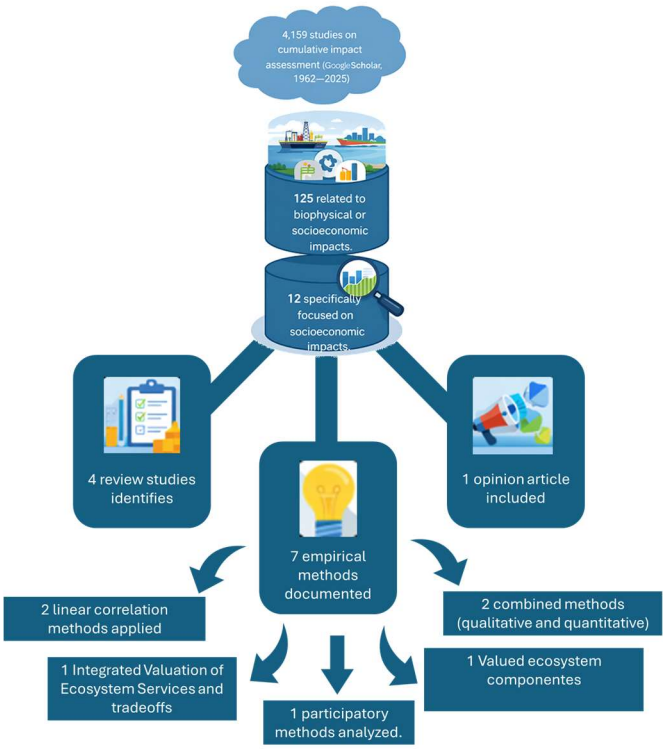
included in the regional scope of the program. The objective is to support the identification of cumulative impacts, provide evidence for decision-making linked to environmental licensing, and contribute to territorial planning..

## 3. Results

PMAIS produced preliminary results, in its first year of operation, related to its methodological structure, data specialization and the test of collection and integrated analysis of secondary data from the socioeconomic environment of four municipalities included in the regional area of action of the Macro Plan.

The systematic and bibliometric review of the literature on the assessment of cumulative impacts consolidated the state of the art and the selection methods applicable to the socio-environmental context related to the O&G industry. This process included the analysis of national and international articles, considering the specificities of the Santos, Campos and Espírito Santo basins. The aim was to identify gaps and guide the improvement of analytical approaches. The bibliometric review revealed only twelve studies focusing specifically on socioeconomic impacts (see Figure 3), highlighting the need to expand knowledge about these dimensions and demonstrating how the results of the PMAIS can contribute to addressing the scarcity of methodologies for cumulative impacts analysis in the socioeconomic and environment context.

**Figure 3 - Summary of the bibliometric review**



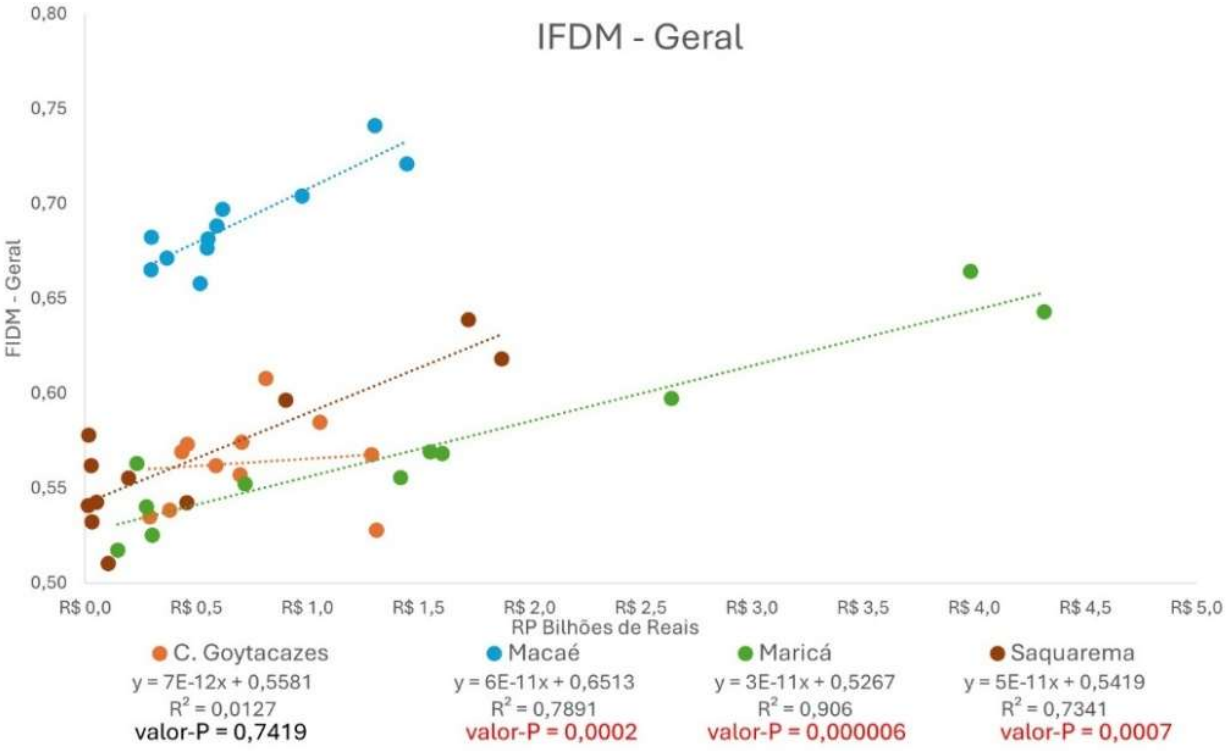

The process of data spatialization supported the construction and operationalization of the BDS. This included the initial calculation of indicators, considering the characterization data of the programs of axis 1 and the implementation of the GPS structure

designed to enable future integration of complementary data. In April 2026, the first datasets were received directly from O&G operators, allowing the generation of maps from input information and establishing the foundation for integrated analyses of social and environmental impacts.

Preliminary tests of integrated data analysis resulted in the identification of initial correlation indices between the socioeconomic development of four municipalities in the state of Rio de Janeiro (Campos dos Notecases, Macaé, Maricá and Saquarema) and the revenues from oil exploration (see Figure 4). These results provide a basis for comparative analyses, suggesting the existence of a relationship between local economic development and resources flows from O&G activities, thereby supporting a better understanding of these interactions.

The expected outcomes of full PMAIS implementation in the coming years include the development of yearbooks to present the characterization of socioeconomic phenomena, methodological consolidation, application of integrated data analysis to guide mitigation actions, strengthening of public environmental management in an integrated manner, improvement of transparency in decision-making processes, and enhancement of IBAMA's analytical capacity. Together, these elements establish the foundation for the use of integrated socio-environmental data analysis as an instrument to support public policy.

**Figure 4 - Integrated data analysis testing**




## 4. Discussion

One of the main challenges of environmental licensing is conducting integrated assessments that consider the impacts of a project within the broader context of other projects located in the same territory. In the offshore oil and gas (O&G) industry, this task is particularly complex, as exploration and production activities are distributed across multiple fields and enterprises operated by different companies.

To address this scenario, it is necessary to develop new instruments and processes that incorporate information technology and enable analytical integration of data. Such integration must align with the principles of environmental management established by Brazilian legislation.

This context highlights the demand for innovative models of public environmental management that not only integrate data used in Environmental Impact Assessments (EIA) but also create spaces for dialogue among environmental agencies, industry operators, and society. These interactions aim to strengthen shared understandings among stakeholders involved in the O&G value chain.

IBAMA's initiative to launch the Macro Plan, structured through programs such as PMAIS, represents an effort to enhance analytical capacity, improve transparency in decision-making, and promote integrated environmental governance. Furthermore, PMAIS contributes to addressing misinformation by supporting the appropriate use of communication in impact assessment processes. In this regard, the program aligns with international debates on cumulative impact assessment and communication strategies, which are central themes of the 2026 IAIA annual conference.

## 5. Conclusions

The contributions of PMAIS to the assessment of cumulative impacts in the Global South focus on the integrated and long-term assessment of the social, economic and environmental dimensions in a macro-regional management context. The proposed methodology seeks to structure a continuous analysis of socioeconomic data related to O&G production and flow activities, overcoming the fragmentation present in traditional EIA approaches.

The Macro Plan introduces an articulating role that strengthens governance and transparency in the relationship between the environmental agency and O&G operators engaged in offshore activities. At the same time, it proposes new methods for constructing and managing territorialized knowledge about phenomena associated with the O&G production chain. Its implementation seeks to ensure integrated actions and reduce the overlap of efforts and environmental requirements imposed through licensing processes.

In the future, information generated through integrated data analysis, conducted by multidisciplinary teams and transdisciplinary approaches, may serve as a tool to address misinformation in the field of impact assessment, ensuring that results are based on verifiable evidence.

Finally, from the perspective of communication and combating disinformation, PMAIS reinforces the role of cumulative impact assessment as an instrument to support responsible

decision-making and the construction of social communication processes based on reliable facts and scientific knowledge.

## 6. Acknowledgments

The Macro-regional Program for Socio-Environmental Impact Assessment (PMAIS) is an action of federal environmental licensing, conducted by Ibama, for the production and flow of oil and natural gas operations of operators operating in the Santos, Campos and Espírito Santo Basins.

In this context, Petrobras promoted, between the end of 2024 and the beginning of 2025, a bidding process under the terms of Federal Law No. 13,303/2016, which resulted in the hiring of the Fundação Instituto de Administração (FIA), responsible for implementing the technical instruments of methodological integration (ITIMs) of the Macro Plan.

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