

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

Title: *Macro Plan: Innovation in Impact Management for the Oil and Gas Supply Chain*

Authors:

Presenting Author: *Kamila Louzada Rangel – BRAZIL – kamilalr@fia.com.br (www.linkedin.com/in/kamila-rangel-klr)*

Coauthors: *Lucas Candido (lucas.C@fia.com.br), Julio Dias (julio.dias@ibama.gov.br), Bruno Teixeira (bruno-bernardes.teixeira@ibama.gov.br), Graziela Oliveira (grazielasro@petrobras.com.br) and Hélio Janny Teixeira (janny@usp.br)*

Abstract

The Macrorregional Plan for the Management of Synergistic Impacts of Maritime Oil and Natural Gas Production and Transportation Activities (Macro Plan) represents a new management approach developed since 2019 by Ibama (Instituto Brasileiro de Meio Ambiente e Recursos Naturais Renováveis), in coordination with operating companies and implementing entities in federal environmental licensing. In its implementation phase, it integrates actions of identification, georeferencing, monitoring, assessment, communication, and mitigation of socio-environmental impacts in the Santos, Campos, and Espírito Santo Basins, covering 97 municipalities in five Brazilian states. Based on the National Environmental Policy, the Macro Plan strengthens public environmental management and seeks to overcome the limitations of traditional licensing, which evaluates projects in isolation and does not adequately capture cumulative and synergistic impacts of multiple projects operating interdependently in the same region. Composed of 13 programs—six for characterizing the supply chain, logistics, and external phenomena (such as oil revenues and fishing activity), one for integrated assessment, one for social communication, and four for mitigation—it includes the Socioeconomic Database (BDS), a key structure for storing georeferenced data and calculating indicators. This database expands understanding of the territorial effects of the Oil and Gas production chain, supporting macrorregional analyses and the proposal of more assertive mitigation actions.

Introduction

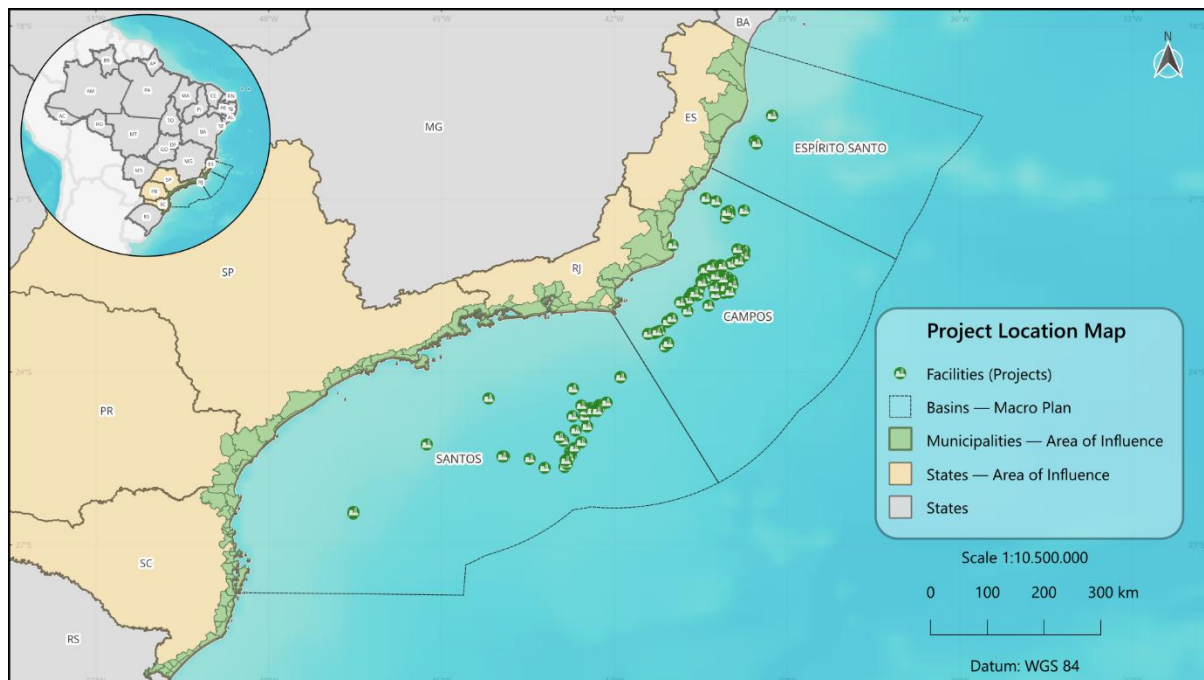
This article presents the Macrorregional Plan for the Management of Synergistic Impacts of Maritime Oil and Natural Gas Production and Transportation Activities — referred to as the Macro Plan — as an innovative socio-environmental management instrument in federal environmental licensing. The Macro Plan has been developed and led by the Brazilian Institute of Environment and Renewable Natural Resources (Ibama) in partnership with oil and gas operating companies in the Macro Plan pilot region for seven years. Its conceptual foundations, programmatic structure, and contribution to the incorporation of the cumulative and synergistic dimension of environmental impacts into public decision-making are highlighted. The focus falls especially on the programs implemented through the Macro Plan Methodological Integration Technical Instruments Project (ITIMs Project), in its first implementation phase since May 2025.

Brazilian federal environmental licensing has historically been structured around the individual analysis of projects, with evident limitations in contexts marked by the spatial concentration of productive activities, in which impacts manifest cumulatively and synergistically. In the context of maritime oil and gas activities, this complexity is expressed with particular intensity: the production chain involves an extensive logistics network, support infrastructure, worker flows, and economic and social effects on coastal municipalities and inland regions.

According to data from the latest EPE summary report (2025), the oil and natural gas sector accounted for 43.6% of domestic energy supply in 2024. The Santos, Campos, and Espírito Santo Basins — the Macro Plan pilot area — concentrated approximately 98% of national oil production in 2025, making it strategic for monitoring socio-environmental impacts (Figure 1). In this context, the shift of productive activities from the Campos Basin to the Santos Basin and the accelerated decommissioning process in the Espírito Santo Basin stand out, driving significant regional changes such as the abrupt reduction of oil revenues in municipalities historically dependent on these resources.

To strengthen governance in environmental licensing, Ibama proposed the Macro Plan in 2019. Its institutionalization is supported by Normative Instruction No. 14/2023 and Technical Information No. 03/2024. The Plan seeks to promote the integration of procedures for the identification, monitoring, assessment, and mitigation of socio-environmental impacts across the Santos, Campos, and Espírito Santo Basins, currently covering 97 municipalities in five Brazilian states (Figure 1). Its implementation occurs through standardized macrorregional programs carried out by operating companies, institutionally coordinated by the Interinstitutional Coordination Committee (CCI in Portuguese) established by Normative Instruction No. 14/2023.

Figure 1 – Macro Plan Coverage Area

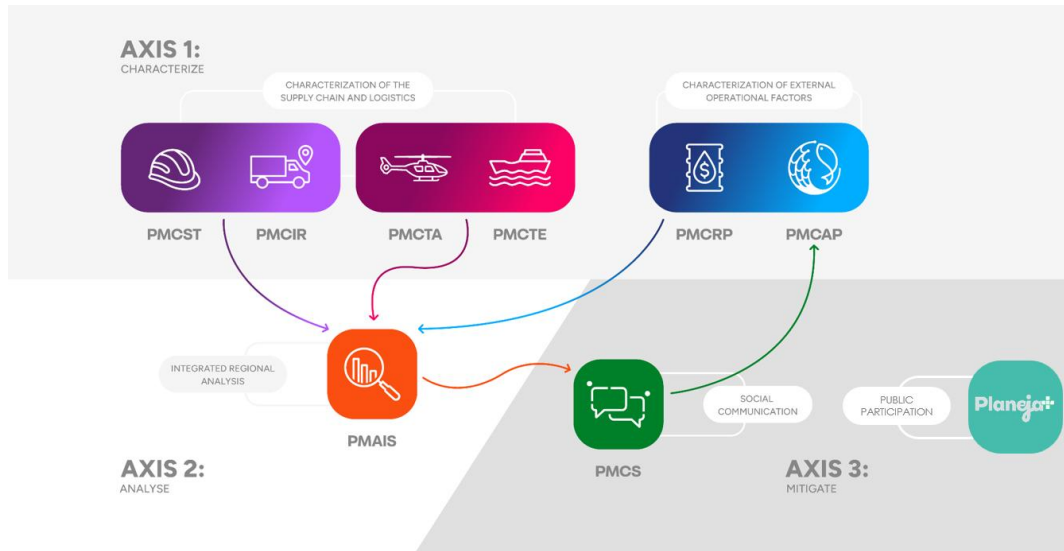


Methodology

The research is qualitative and descriptive in nature, based on documentary analysis. The following documents were examined: Normative Instruction No. 14/2023 (IBAMA); Technical Information No. 03/2024 (IBAMA); and the Methodological Proposals for the seven programs developed within the ITIMs Project. The analysis was conducted through analytical reading and thematic categorization, aiming to identify: (i) the conceptual foundations of the Macro Plan; (ii) the structure of the macrorregional axes and programs; and (iii) the integration mechanisms for managing synergistic impacts.

The Macro Plan comprises eleven programs organized into three axes, as illustrated in Figure 2: Axis 1 (Characterization), with six programs; Axis 2 (Integrated Assessment), with one program; and Axis 3 (Mitigation), encompassing social communication and three mitigation programs. This article focuses on the seven programs operationalized by the ITIMs Project, which are briefly described below:

Figure 2 – Macro Plan Axes Structure



- **Macrorregional Aircraft Traffic Characterization Program (PMCTA, in Portuguese):** characterizes air operations supporting offshore logistics activities, identifying the intensity, frequency, and spatial distribution of air traffic and its socioeconomic effects on municipalities with airport infrastructure.
- **Macrorregional Vessel Traffic Characterization Program (PMCTE, in Portuguese):** analyzes the flow of vessels involved in the maritime logistics chain, including routes, anchorage and berthing areas, and demands on ports and terminals, assessing overlaps with other uses of maritime and coastal space.
- **Macrorregional Supply and Waste Transport and Disposal Characterization Program (PM CIR, in Portuguese):** monitors the spatial distribution of land-based activities related to the network of input suppliers, waste disposal service providers, and associated logistics infrastructure.
- **Macrorregional Workers' Socio-Spatial Dynamics Characterization Program (PMCST, in Portuguese):** characterizes the socioeconomic, spatial, and occupational profile of the workforce linked to maritime activities, considering employment contracts, education, income, gender, race, and commuting patterns.
- **Macrorregional Oil Revenue Characterization Program (PMCRP, in Portuguese):** monitors the generation and distribution of oil revenues, the degree of budgetary dependence of municipalities and states on these revenues, and the existence of social oversight mechanisms in the territories.

- **Macrorregional Socio-Environmental Impact Assessment Program (PMAIS, in Portuguese):** integrates the indicators produced by the Axis 1 programs, promoting regional analyses capable of establishing cause-and-effect relationships and expanding the understanding of the cumulative and synergistic impacts of the oil and gas industry.
- **Macrorregional Social Communication Program (PMCS, in Portuguese):** unifies previously fragmented communication practices by adopting multiple instruments: an online portal, social media, bulletins, audiovisual tools, press relations, in-person events, and strategies prioritized according to the specific contexts of each target audience.

The Axis 1 programs are guided by Methodological Proposals developed participatively among the environmental authority, operating companies, and the ITIMs Project implementing team. Companies collect data annually and submit it to the ITIMs Project through the Socioeconomic Database (BDS), which carries out an automatic validation step, followed by technical team analysis, normalization, and validation of the submitted data.

Additionally, secondary data are collected by the implementing team to supplement the data submitted by the operators. Technically validated data support the calculation of indicators and indices for integrated analyses within the PMAIS. In order to ensure transparency of Macro Plan activities and communicate federal O&G environmental licensing actions to the general public, Annual Bulletins disseminate the main results of each program. The first Macro Plan Socioeconomic Characterization Yearbook is expected in 2026, presenting all calculated indicators as well as integrated analyses from the Axis 1 Characterization Programs.

In this way, the Macro Plan develops as a living mechanism, continuously updated and evolving. Its methodology includes a critical review and annual revision of the methodologies of its various constituent programs.

Results

Although the ITIMs Project is at the beginning of its first phase, which began in May 2025, it is already possible to identify relevant results. Of particular note is the progress in institutional coordination among the Project's technical teams, IBAMA, and the teams of the ten participating operating companies (BW Energy, Brava, Equinor, Karoon, Petrobras, Perenco, Prio, Shell, TotalEnergies, and Trident), a sector responsible for more than 10% of Brazil's GDP (EPE, 2024).

A structured effort to improve data collection, processing, and presentation procedures is underway, aiming to ensure traceability, accuracy, and reliability of information in the BDS. This process faces challenges related to the availability of secondary data and the operational specificities of each company, characterized by high logistical complexity and large volumes of data that are geographically and sectorally dispersed. For the first time since 2019, Ibama

has a dedicated team to provide technical advisory support for decisions regarding the direction and improvement of the programs.

The main challenge identified is the standardization of methodologies and data produced by the different operators, an indispensable condition for calculating representative macrorregional indicators. To this end, individual meetings were held with each operating company for the mapping of specificities and targeted guidance, resulting in advances in terminological standardization and in the qualification of tabular and georeferenced data — essential inputs for the production of maps and macrorregional spatial analyses. These advances enabled the calculation of initial indicators that formed the basis of the first annual bulletins of the Programs, constituting an essential foundation for the integrated temporal analyses within the PMAIS.

Discussion

The preliminary results demonstrate a consistent movement toward overcoming limitations historically identified in federal environmental licensing, particularly with regard to the fragmented analysis of impacts. This progress aligns with the critiques of Sánchez (2020; 2023), according to whom Environmental Impact Assessment (EIA), when applied in a strictly project-based manner, tends to underestimate effects arising from the interaction of multiple human activities in the same territory over time.

The structuring of the Macro Plan as a macrorregional instrument addresses gaps in Brazilian environmental legislation. Although CONAMA Resolution No. 01/1986 established EIA as a fundamental requirement of environmental licensing, its original formulation did not specify operational mechanisms for the assessment of cumulative impacts. As Carvalho and Marques (2025) note, this provision remains diffuse in federal legislation. The standardization of indicators and the centralization of information in the BDS constitute key elements for enabling the integrated analyses that Sánchez (2023) identifies as a necessary condition for the assessment of cumulative and synergistic impacts.

The difficulty of harmonizing data collection and management practices among multiple actors reflects structural challenges discussed by Dias (2018), who analyzes institutional fragmentation and asymmetry in technical capacities as factors that produce formal and poorly integrated assessments. The ITIMs Project's effort to promote methodological convergence represents a relevant counterpoint to this pattern. The PMCST and PMCRP programs broaden the analytical scope by incorporating socioeconomic dimensions — such as labor mobility, budgetary dependence on oil revenues, and regional volatility — that are directly related to the environmental justice debate (ACSELRAD; MELLO; BEZERRA, 2009).

The integration of this data into the PMAIS brings the Macro Plan closer to contemporary integrated impact assessment approaches, as discussed by Dibo (2018), who

highlights the need for reference frameworks capable of articulating multiple pressure vectors, spatial scales, and temporal horizons. Finally, the centrality of the PMCS reinforces the Macro Plan's potential to contribute to greater transparency and social oversight, advancing toward a more accessible form of environmental licensing that is sensitive to territorial inequalities (ACSELRAD; MELLO; BEZERRA, 2009).

Conclusion

This article analyzed the Macro Plan as an innovative instrument of federal environmental licensing, with emphasis on the programs operationalized by the Macro Plan Integration Project. The initial results indicate that the Plan establishes consistent institutional and methodological foundations for incorporating the cumulative and synergistic dimension of socio-environmental impacts, overcoming the limitations of the model centered on the isolated analysis of projects.

The ITIMs Project proves to be a central element for the practical implementation of the Macro Plan, advancing in terminological standardization and in the harmonization of data collection, processing, and analysis procedures among multiple operating companies. This work has made it possible to transform dispersed and heterogeneous information into comparable databases, an essential condition for the production of macrorregional integrated indicators and analyses, thereby strengthening the environmental authority's decision-making capacity through continuous technical support.

The articulation between characterization (Axis 1), integrated assessment (Axis 2), and social communication (Axis 3), made possible by the Macro Plan Integration Project, points toward a model of environmental management that is more transparent, territorially sensitive, and compatible with the complexity of the oil and gas industry in Brazil. The consolidation of this arrangement over time is expected to enhance the effectiveness of federal environmental licensing and to more consistently guide the proposal of mitigation measures at a regional scale.

Acknowledgements

The Macrorregional Plan for the Management of Synergistic Impacts of Maritime Oil and Natural Gas Production and Transportation Activities (Macro Plan) is a federal environmental licensing action led by Ibama for oil and natural gas production and transportation operations of the operators active in the Santos, Campos, and Espírito Santo Basins.

In this context, Petrobras conducted, between late 2024 and early 2025, a bidding process pursuant to Federal Law No. 13.303/2016, resulting in the contracting of Fundação Instituto de Administração (FIA), responsible for implementing the Macro Plan Methodological Integration Technical Instruments (ITIMs).

On behalf of the FIA team, the following acknowledgements are registered:

To the organizers of the 45th Annual Conference of the International Association for Impact Assessment;

To Petrobras for its support of the ITIMs Project;

To the operating companies Brava Energia, BW Energy, Equinor, Karoon Energy, Perenco, PRIO, Shell, TotalEnergies, and Trident Energy, involved in the implementation of the Macro Plan; and

To Professor Dr. Luis Sánchez and Professor Juliana Siqueira-Gay of the Polytechnic School of the University of São Paulo (USP) for the invitation and trust placed in our team to participate in the session at IAIA26 – Québec City, Canada, on Perspectives on the Assessment of Cumulative Impacts in the Global South.

References

- Achselrad, H., Mello, C. C. do A., & Bezerra, G. das N. (2009). O que é justiça ambiental. Garamond.
- Brasil. Conselho Nacional do Meio Ambiente. (1986). Resolução nº 1, de 23 de janeiro de 1986. Diário Oficial da União.
- Brasil. Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. (2023). Instrução normativa nº 14, de 12 de maio de 2023.
- Brasil. Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. (2024). Informação técnica nº 03, de 13 de março de 2024.
- Carvalho, M. B. de, & Marques, E. E. (2025). Previsão da avaliação de impactos cumulativos na legislação ambiental federal brasileira. In Anais do 7º Congresso Brasileiro de Avaliação de Impacto (CBAI). Galoá Proceedings.
- Dias, J. C. S. (2018). O manejo interinstitucional da "degradação legítima": A burocratização subordinada da avaliação de impactos ambientais no planejamento territorial coordenado pela política energética brasileira (Tese de doutorado, Universidade Federal do Rio de Janeiro).
- Dibo, A. P. A. (2018). Avaliação de impactos cumulativos para a biodiversidade: Uma proposta de quadro de referência no contexto da avaliação de impacto ambiental de projetos (Tese de doutorado, Universidade de São Paulo).
- Empresa de Pesquisa Energética. (2025). BEN 2025: Relatório síntese (ano base 2024).
- Fundação Instituto de Administração. (2025). 1º boletim anual do Programa Macrorregional de Caracterização de Rendas Petrolíferas (PMCRP). <https://informapetroleo.com.br/noticias/110>
- Sánchez, L. E. (2020). Avaliação de impacto ambiental (2ª ed.). Oficina de Textos.
- Sánchez, L. E. (2023). Avaliação de impactos cumulativos. Oficina de Textos.