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ANALYSING THE LEGAL AND REGULATORY FRAMEWORK FOR DECOMMISSIONING OFFSHORE PLATFORMS: A COMPARISON BETWEEN BRAZIL (BR) AND THE UNITED KINGDOM (UK)

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ABSTRACT

Purpose: This article aims to analyze the legal structure of the dimensions involved in the decommissioning process and its implications on the procedures adopted by United Kingdom and the Brazil, based on a systematic literature review.

Methodology: The research was conducted through a systematic literature review, analyzing articles obtained from three main databases: CAPES, Crossref, and Google Scholar, in addition to other relevant sources.

Results & Discussion: The analysis sought to understand the debate surrounding the applicability of the norms and regulations related to offshore platform decommissioning in both territories. The results indicate that United Kingdom and the Brazil align their legal policies for offshore platform management with international best practices in sustainability. However, contradictions in the implementation of these policies arise, often due to conflicts of interest among the parties involved, a situation more pronounced in Brazil.

Conclusion: The analysis reveals that, although both countries strive to align their policies with international standards, national specifics and challenges present difficulties in the application of regulations. The main implication of this study is to provide a systemic view of the decommissioning process, integrating the applicable regulatory dimensions. The study also points to directions for future research, particularly regarding the improvement of policy implementation and the resolution of conflicts of interest in the decommissioning process.

Keywords: Offshore Decommissioning, Regulation, Conflict, Sustainability.

ANÁLISE DO MARCO LEGAL E REGULAMENTAR PARA DESCOMPLICAÇÃO DE PLATAFORMAS OFFSHORE: UMA COMPARAÇÃO ENTRE O BRASIL (BR) E O REINO UNIDO (UK)

RESUMO

Objetivo: Este artigo tem como objetivo analisar a estrutura legal das dimensões envolvidas no processo de descomissionamento e suas implicações nos procedimentos adotados pelo Brasil e pelo Reino Unido, com base em uma revisão sistemática da literatura.

Metodologia: A pesquisa foi conduzida por meio de uma revisão sistemática da literatura, analisando artigos obtidos de três principais bases de dados: CAPES, Crossref e Google Scholar, além de outras fontes relevantes.

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Resultados & Discussão: A análise buscou compreender o debate sobre a aplicabilidade das normas e regulamentações relacionadas ao descomissionamento de plataformas offshore em ambos os territórios. Os resultados indicam que Reino Unido e o Brasil alinham suas políticas legais para a gestão de plataformas offshore com as melhores práticas internacionais em sustentabilidade. No entanto, surgem contradições na implementação dessas políticas, muitas vezes devido a conflitos de interesse entre as partes envolvidas, uma situação mais pronunciada no Brasil.

Conclusão: A análise revela que, embora ambos os países se esforcem para alinhar suas políticas aos padrões internacionais, especificidades nacionais e desafios apresentam dificuldades na aplicação das regulamentações. A principal implicação deste estudo é fornecer uma visão sistêmica do processo de descomissionamento, integrando as dimensões regulatórias aplicáveis. O estudo também aponta direções para futuras pesquisas, especialmente no que diz respeito à melhoria da implementação das políticas e à resolução de conflitos de interesse no processo de descomissionamento.

Palavras-chave: Descomissionamento Offshore, Regulamentação, Conflito, Sustentabilidade.

ANÁLISIS DEL MARCO LEGAL Y REGULADOR PARA EL DESMANTELAMIENTO DE PLATAFORMAS OFFSHORE: UNA COMPARACIÓN ENTRE BRASIL (BR) Y EL REINO UNIDO (UK)

RESUMEN

Objetivo: Este artículo tiene como objetivo analizar la estructura legal de las dimensiones involucradas en el proceso de desmantelamiento y sus implicaciones en los procedimientos adoptados por Brasil y el Reino Unido, basado en una revisión sistemática de la literatura.

Métodología: La investigación se llevó a cabo mediante una revisión sistemática de la literatura, analizando artículos obtenidos de tres principales bases de datos: CAPES, Crossref y Google Scholar, además de otras fuentes relevantes.

Resultados y Discusión: El análisis buscó comprender el debate sobre la aplicabilidad de las normas y regulaciones relacionadas con el desmantelamiento de plataformas offshore en ambos territorios. Los resultados indican que Brasil y el Reino Unido alinean sus políticas legales para la gestión de plataformas offshore con las mejores prácticas internacionales en sostenibilidad. Sin embargo, surgen contradicciones en la implementación de estas políticas, a menudo debido a conflictos de intereses entre las partes involucradas, una situación más pronunciadas en Brasil.

Conclusión: El análisis revela que, aunque ambos países se esfuerzan por alinear sus políticas con los estándares internacionales, las especificidades nacionales y los desafíos presentan dificultades en la aplicación de las regulaciones. La principal implicación de este estudio es proporcionar una visión sistémica del proceso de desmantelamiento, integrando las dimensiones regulatorias aplicables. El estudio también señala direcciones para futuras investigaciones, especialmente en lo que respecta a la mejora de la implementación de políticas y la resolución de conflictos de interés en el proceso de desmantelamiento.

Palabras clave: Desmantelamiento Offshore, Regulación, Conflicto, Sostenibilidad.

1 INTRODUCTION

The exploration of fossil fuels is an ancient activity that initially focused on onshore extraction, i.e., on land. It was only later that exploration began to be conducted offshore, referring to the extraction of oil, gas, and other natural resources at sea, typically from platforms installed offshore. As available oil and gas resources are depleted, existing infrastructure becomes obsolete, leading to cases of "abandonment" and "decommissioning" (Paterson, 2018, pp. 1-12).

Given the complexity of operations and the environmental impacts associated with fossil fuels, the state plays a crucial role in environmental preservation and operational safety, using legal and regulatory instruments. Decommissioning projects are governed by strict national and international standards (Fowler et al., 2014). According to the definition by the National Agency of Petroleum, Natural Gas, and Biofuels of Brazil - ANP (2020), decommissioning facilities involves halting operations, the abandonment and decommissioning of wells, the removal of structures, proper disposal of waste, and environmental recovery of the area.

This article aims to conduct a comparative analysis of the regulatory standards related to offshore decommissioning in the United Kingdom and Brazil. The research seeks to assess the applicability of these regulations and examine their alignment with international standards in both countries. The analysis revealed that the policies adopted by United Kingdom and the Brazil align with sustainability principles and are subject to a rigorous regulatory framework that imposes specific obligations according to each country's legal and regulatory provisions. The United Kingdom, being a pioneer in decommissioning, shows significant progress in terms of legislation and practices. In contrast, Brazil is improving its legal policies related to offshore decommissioning, incorporating lessons learned and following international best practices.

Although both territories present distinct regulatory models, they have developed significant public policies for the management of offshore platforms. The United Kingdom began full decommissioning in the 20th century and adopted the partial decommissioning method in the 21st century. Conversely, Brazil, being more recent in oil exploration, also opted for the partial method (ANP, 2020). Both countries face conflicts of interest among the parties involved in offshore decommissioning, although this issue is more pronounced in Brazil (Delgado, Moura, & França, 2021).

2 METHODOLOGY

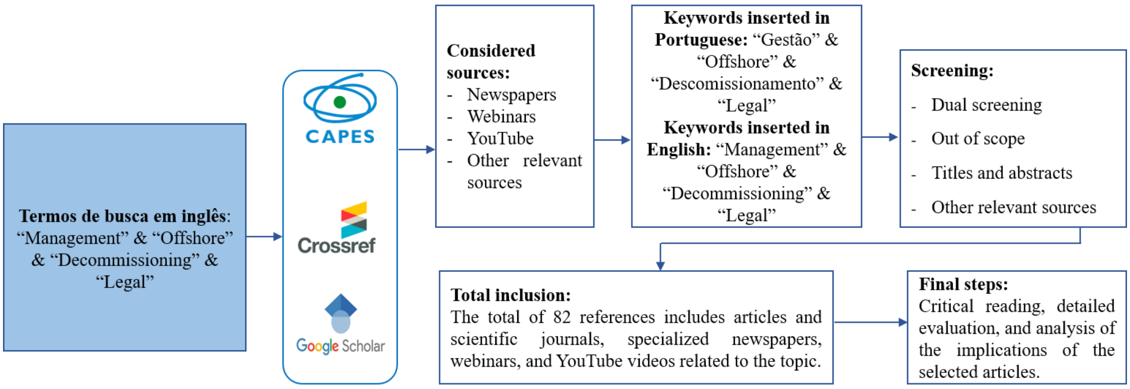
This article is based on the analysis of relevant studies on the research topic, focusing on the legislation regulating the offshore decommissioning process in two territories: the United Kingdom (UK) and Brazil (BR). A survey was conducted of publications in Portuguese on "Regulação de Descomissionamento Offshore" (Offshore Decommissioning Regulation) in Brazil, and in English on "Offshore Decommissioning Regulation" in the United Kingdom. The research was carried out through three main sources: the CAPES Journal Portal (Coordination for the Improvement of Higher Education Personnel), Crossref, and Google Scholar, along with other relevant sources.

2.1 SEARCH STRATEGY

The search strategy used specific descriptors, as illustrated in the flowchart in figure 1, to filter the results. The article selection process followed three stages: i. Reading the titles; ii. Reading the abstracts; and iii. Full-text reading, with a detailed analysis. Articles were selected based on the following inclusion criteria: i. Specific focus on the topic "Offshore Decommissioning Regulations" ii. Full scientific article format: journals, books, and other relevant sources, such as webinars and newspapers; and iii. Publication in Portuguese or English.

Figure 1

Stages for identifying data from the defined sources.



Source: Authors elaboration.

2.2 SELECTION RESULTS

At the end of the selection process, the scientific references that met the previously established eligibility criteria, covering two jurisdictions, were chosen. In total, 82 references were identified, consisting of scientific articles, specialized journals, books, and webinars, all relevant to the issues under analysis. Of these, approximately 44 references were extracted from Crossref, 22 from Google Scholar, 9 from the CAPES portal, and 6 from other relevant sources (Figure 2).

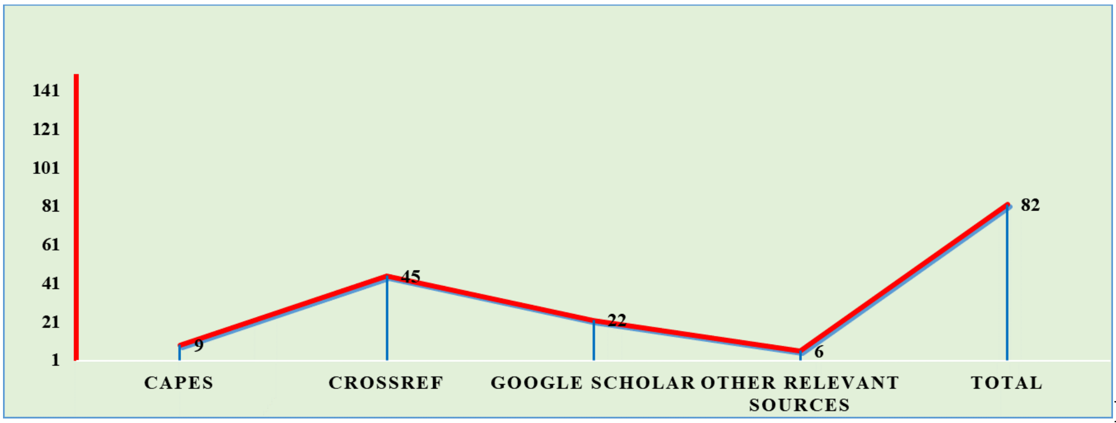


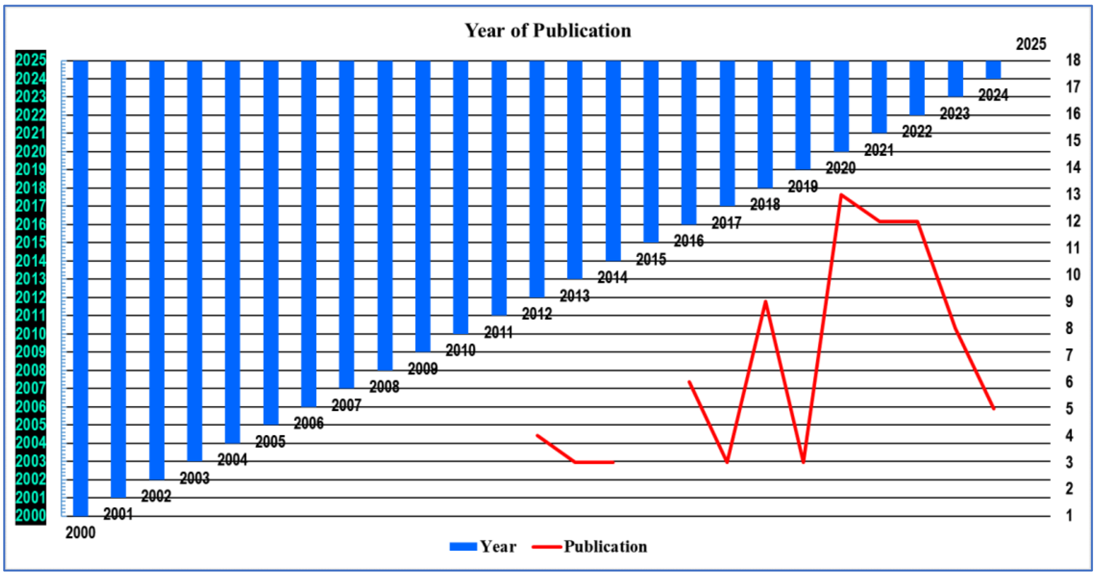
Figure 2 – Total identification of references in the databases and other sources.

Source: Authors' elaboration.

It is worth noting that the references were obtained between 2000 and 2024, showing a diverse temporal distribution. On average, between 6 and 13 publications were selected per year, with a higher incidence between 2018 and 2020. In contrast, the number of publications was significantly lower between 2010 and 2016, ranging from 1 to 6 per year (Figure 3).

Figure 3

Publications from different years, based on the screening process.



Source: Authors' elaboration.

3 RESULTS AND DISCUSSION

The scientific literature on offshore decommissioning, in the contexts of the UK and Brazil (BR), can be organized into two distinct approaches. The first perspective, widely supported by various scholars, argues that UK legislation is more advanced in decommissioning regulation, with consolidated legal systems that prioritize responsibility and sustainability (Day & Gusmitta, 2016; Fam et al., 2018).

The second approach argues that Brazilian regulations are following international best practices in sustainability for decommissioning (Teixeira & Machado, 2012; ANP, 2020; Steenhagen, 2020; Energy Information Administration - EIA, 2022; Kowarski & Rosado, 2023). These authors contend that, despite ongoing challenges, Brazil has made significant progress in its regulatory framework, with continuous improvements in legislation in recent years.

Although Brazil has a lower number of decommissioned platforms compared to the UK, its laws are almost fully aligned with international best practices. It is important to highlight that, due to the scarcity of previous experiences in the country, many decisions are made based on uncertain premises and are often influenced by political pressures. However, regulatory bodies operate within the confines of existing laws, although contradictions in decision-making still persist (Tribunal de Contas da União - TCU, 2021; Delgado, Moura, & França, 2021).

3.1 UK - REGULATORY STANDARDS

The Brent Spar incident, which occurred in 1995 in the North Sea, exposed failures and raised awareness about the need for good sustainable practices, with an emphasis on safety, recycling, and waste management. This event reinforced the necessity for regulation and corporate responsibility to preserve marine resources (Jordan, 2001). According to Paterson (2018), the incident highlighted the negative public reaction, with campaigns by groups such as Greenpeace and civil society influencing corporate policies and maritime environmental standards.

Following this incident and other similar experiences, the UK became a leader in regulatory policies and international safety standards for maritime environments, significantly contributing to global maritime safety (Zagonari, 2024). Since then, the country has approached decommissioning and environmental management with increased attention and a commitment to sustainable practices in the offshore sector (Gordon, 2020). The primary British regulator is the Offshore Petroleum Regulator for Environment & Decommissioning (OPRED), responsible for approving and monitoring all oil installations and pipelines on the UK Continental Shelf (OPRED, 2022). Table 1 presents the British regulations on the subject.

Table 1

British Regulations on Offshore Installation Decommissioning.

Principal Legislation
- Petroleum Act 1998 & Energy Act 2008 - Marine & Coastal Access Act 2009, Marine (Scotland) Act 2010 - The Coast Protection (Variation of Excluded Waters) (England) Regulations 2015 - The Marine Licensing (Delegation of Functions) (Amendment) Order 2015 & The Marine Licensing (Exempted Activities) (Scottish Onshore and Offshore Regions) Amendment Order 2012 - The Merchant Shipping (Prevention of Air Pollution from Ships) (Amendment) Regulations 2021 - The Merchant Shipping (Prevention of Pollution by Garbage from Ships) Regulations 2020 - The Offsho2re Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2010 - The Pipeline Safety Regulations 1996 - Convention for the Protection of the Marine Environment of the North-East Atlantic 1992 (OSPAR Convention) - OSPAR Decision 98/3 & OSPAR Recommendation 2006/5: Offshore Drilling Waste Management Scheme - Conservation of Offshore Marine Habitats and Species Regulations 2017 - Control of Mercury (Enforcement) Regulations 2017 - Energy Act 2008 (Consequential Amendments) (Offshore Environmental Protection) Order 2010 - Energy Act 2008, Part 4A Consent to Locate Energy Savings Opportunity Scheme 2014 - Environmental Assessment of Plans and Programmes Regulations 2004 - Fluorinated Greenhouse Gases Regulations 2015 - Regulamento de Gases de Efeito Estufa Fluorados de 2015 - Food and Environment Protection Act 1985, Part II Deposits in the Sea - Greenhouse Gases Emissions Trading Scheme (ETS) - Merchant Shipping (Convention on Cooperation in the Preparation and Response to Hydrocarbon Pollution) Regulations 1998 - Marine and Coastal Access Act 2009 & Marine Strategy Regulations 2010 - Offshore Chemicals Regulations 2002 (as amended) - Offshore Combustion Installations (Prevention and Control of Pollution) Regulations 2013 (as amended) - Offshore Installations (Emergency Pollution Control) Regulations 2002 - Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020
Supporting Legislation
□ Offshore Petroleum Activities (Habitats Conservation) Regulations 2001 (as amended) □ Offshore Petroleum Activities (Prevention and Control of Hydrocarbon Pollution) Regulations 2005 (as amended) □ Offshore Petroleum Licensing Regulations (Offshore Safety Directive) 2015 □ Ozone-Depleting Substances Regulations 2015 & REACH Enforcement Regulations 2008 □ Oil and Gas: fees and charges
Waste Management
□ Radioactive Substances Act 1993 □ Regulations on the Transboundary Transport of Radioactive Waste and Spent Fuel (2019)
Guidelines 2

-Department for Energy and Nuclear Safety: Guidance Note for Operators – Offshore Oil and Gas Sector: Update on Marine Planning in the UK. This Guidance Note provides an update for the oil and gas sector on the UK's marine planning process, focusing on environmental impact assessments (EIAs) associated with decommissioning activities within a marine planning area. - Common Data Access (CDA) Guidance – Retention of Information and Samples After the Decommissioning of Offshore Assets on the United Kingdom Continental Shelf (UKCS). - Guidance Notes (Draft) on Offshore Installation and Pipeline Decommissioning in Combination with the Energy Act 2008. - New Guidelines from the Department for Energy and Nuclear Safety are Pending. - IMO Guidelines for the Removal of Offshore Installations and Structures in the Continental Shelf in the Exclusive Economic Zone 198. - Simplified Decommissioning Program Model (cases not derived from derogation) (11/2018). - Health and Safety Executive (HSE) Fact Sheets on Structural Integrity Requirements for the Decommissioning and Dismantling of Fixed Offshore Installations.

Source: Department for Energy Security and Net Zero, Offshore Petroleum Regulator for Environment and Decommissioning, & Department for Business, Energy & Industrial Strategy, (2024).

3.1.1 Adjustments According to International Standards

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Table 1 presents the main conventions to which the UK is a leader, founding member, signatory, and part of the permanent council, thus playing a crucial role in shaping regulatory policies for maritime management. According to BEIS (2018), these treaties and agreements ensure that, whenever possible, decommissioning is carried out in a way that protects the environment, ensures the safety of other sea users, and respects the involved communities.

Table 1

International and Regional Conventions to which the UK is a Signatory.

Convention	Role and Importance	References
London Dumoing Convention (LDC, 1972)	It protects the marine environment and prevents pollution caused by harmful substances from platforms.	Verlaan *et al.*, 2010; Shin, 2012, Alramahi 2021;
International Maritime Organization (IMO, 1948)	Políticas jurídicas marítimas e controle da poluição.	Trevisanut, 2020
United Nations Convention on the Law of the Sea (UNCLOS, 1982)	It establishes rights over marine resources and territorial waters, in addition to aspects related to management during offshore decommissioning.	Trevisanut, 2020; Beckman, 2013; Bergamaschine & Cobucci 2021;
Marine Polution (MARPOL, 1973)	It establishes the legal basis for maritime management, prevention of pollution from ships, and oil spills.	Whomersley *et al.*, 2016; Bergamaschine & Cobucci, 2021; Beadnall, 2022
OSPAR Convention (1972)	It regulates the disposal of hazardous substances and the abandonment of platforms, serving as a landmark in international maritime law.	Verlaan *et al.*, 2010; Shin, 2012; Bergesen, 2018; Aldersey-Williams, 2018;
Safety of Life at Sea (SOLAS, 1980)	The SOLAS Convention, established by the IMO, covers essential aspects related to the safety of human life in all maritime operations, also applying to offshore platforms.	Daniels (2024); Jung (2023),

Source: Authors' elaboration.

Some of the requirements outlined in these treaties and international agreements are used as references for the formulation of government policies and strategies or those of regulatory bodies, while others are incorporated into British law and applied by the competent regulatory authorities (OPRED, 2022). The UK legislation on offshore decommissioning is based on the obligations assumed by the country under international conventions and European Union legislation (Health and Safety Executive - HSE, 2015; BEIS, 2018; OPRED, 2022).

Owners of oil and gas installations and pipelines are legally required to dismantle their infrastructure at the end of a field's economic life (Arup, 2014). According to Ahiaga-Dagbui et al. (2017) and Brett (2020), decommissioning planning and execution ensure compliance with legal obligations, guaranteeing that companies cover the costs and actions necessary for proper removal.

The London Dumping Convention (LDC) sets exemplary licensing and monitoring standards for the disposal of hazardous substances at sea, serving as a reference for global regulations (Mackie & Velenturf, 2021; Krymskaya et al., 2021). Additionally, it is pioneering in the decommissioning operation (Vikane, Selvik, & Abrahamsen, 2021). The UK, as a leader in Category A of the International Maritime Organization (IMO), has played a vital role in creating and evolving maritime regulatory policies (Degraer et al., 2020; Efthympiou, 2021), with comprehensive legislation addressing sustainability in offshore platform deactivation (Aldersey-Williams, 2018).

3.1.2 Degree of Applicability of Regulations

The offshore decommissioning process in the UK must align with best sustainability practices. According to Stacey et al. (2022), coordination among the responsible authorities ensures the implementation of environmental and public safety policies that meet the highest sustainability standards. In 2020, the Oil and Gas Authority estimated that around 600 installations would be decommissioned over the next 30 to 40 years, with 470 of them located in the North Sea (Oil and Gas Authority, 2020).

The UK has extensive experience in this process, having decommissioned 116 fields in 2020, marking the fourth consecutive year in which decommissioning activities surpassed assessments due to well maturity (Fowler et al., 2019; Maslin et al., 2020; Walters, 2022). In the North Sea, the countries stands out as a model for best practices in deactivation (Stacey et al., 2022).

Partial removal or total abandonment of platforms is a practice frequently adopted because it is considered beneficial for the marine ecosystem (Fowler et al., 2018). However, according to Davies & Hastings (2023), the decommissioning process involves the use of heavy machinery and long transport distances, resulting in CO2 emissions and other harmful gases in the atmosphere, contributing to climate change. During the removal or abandonment of platforms, materials may be disturbed, releasing toxic substances into the marine environment. This poses risks to the health of marine ecosystems and coastal communities (Smith, 2010). Therefore, the decommissioning process must be carefully planned and executed, considering both the ecological benefits and potential negative impacts on environmental and human health (Fowler et al., 2019).

When analyzing decommissioning regulations in five countries — UK, United States, Norway, Australia, and the Netherlands — Fam et al. (2018) concluded that UK legislation is the most developed due to its long experience with this process. The IOGP widely adopts the Petroleum Act as a reference to develop decommissioning guidelines for the oil industry in the regional context, with the active participation of the UK as a member of the advisory board (Efthympiou, 2021; Alramahi, 2021).

The technical viability of offshore decommissioning depends on factors such as location, depth, structure type, available technology, logistics, and legislation. Furthermore, the choice between alternatives like partial removal, full removal, abandonment, or reuse presents operational and environmental challenges (Fowler et al., 2018).

The most preferred alternatives in the UK include creating artificial reefs and repurposing structures for offshore wind energy (Lemasson et al., 2020; Mackie et al., 2021), as well as maintaining platforms for sustainable purposes (Schutter et al., 2019). The transformation of platforms into artificial reefs and their reuse for offshore wind energy promotes sustainability; however, they also involve technical and legal challenges that require detailed evaluation. These actions may cause unforeseen changes in local ecosystems, affecting the dynamics of natural habitats and creating long-term ecological imbalances (Coolen, 2017; Mackie et al., 2021).

According to Schutter et al. (2019) and Mackie et al. (2021), after the abandonment of platforms, the risk of contamination leakage persists, posing a continued threat to marine life if wells are not properly sealed. Similarly, repurposing platforms for offshore wind energy and converting them into artificial reefs raises additional environmental concerns (Coolen, 2017; Schutter et al., 2019).

A campaign-driven program was successful in reshaping the offshore infrastructure in the North Sea. This program reduced the number of platforms from eight to six and consolidated gas processing terminals and onshore export terminals from two to one. This restructuring was crucial in substantially reducing operational expenditure (OPEX), enabling the extension of the platforms' lifespan (Oil and Gas Authority, 2021).

The complex technical and environmental challenges resulting from both specialized inclined wells and legacy infrastructure required the implementation of technological innovations in the sector. The supply chain played a crucial role in developing decommissioning solutions through a long-term contractual strategy, resulting in a significant reduction in costs for taxpayers and operators. According to the Oil and Gas Authority (2021), the entry of new participants in the UK and the expansion of services in the sector were integrated with both national and international established suppliers, ensuring the safe execution of the process.

The conversion of structures into wind farms and platforms transformed into artificial reefs contributes to the increase in marine biodiversity by promoting the growth of algae, invertebrates, and fish (Koivisto et al., 2020; Fitnawan et al., 2021). Furthermore, these structures serve as bridges between isolated species populations, promoting ecological connectivity due to their geographic location (Thorpe, 2012; Bergmark & Jørgensen, 2014). The increase in offshore wind farms is being monitored to prevent the spread of invasive species. This technical-legal process is complex and involves multiple stakeholders with often contradictory motivations (Ter Hofstede, Driessen, Elzinga, Van Koningsveld, & Schutter, 2022; Demuytere et al., 2024).

According to Krymskaya et al. (2021) and Zagonari (2024), conflicts of interest arise between concessionaires, regulators, and coastal communities driven by economic, operational, environmental, and legal factors. Each party has distinct objectives and priorities: concessionaires often seek to reduce costs by opting for the permanence of structures or repurposing them for sustainable uses, while regulators demand specific control and monitoring plans. Operators attempt to transfer maintenance costs to government authorities. This dynamic can generate significant risks due to technological and scientific uncertainties (Rigney et al., 2023).

The Petroleum Act establishes a rigorous legal foundation for safety; however, the diversity of interests among the parties involved creates tensions between ecological protection and operational safety (Holland et al., 2016). Environmental groups oppose the conversion of platforms, highlighting the lack of conclusive scientific data on long-term ecological impacts. This intensifies disputes over these negative effects (Shapiro et al., 2012; Brandon, 2023;

Zagonari, 2024). Therefore, as pointed out by Shapiro et al. (2012) and Zagonari (2024), due to the complexity of the situation and the interaction between multiple factors involved in offshore platform decommissioning, conflicts are inevitable.

3.2 BR - REGULATORY STANDARDS

Brazil's environmental legislation covers a wide range of standards that regulate activities such as dismantling, cleaning, demolition, and waste treatment, addressing various marine ecological issues. Among these standards, the guidelines outlined in the IBAMA Technical Note No. 3/2019 are particularly important. This document was developed by the General Coordination of Sustainable Development Programs and Projects, the General Coordination of Environment and Communities, and the Environmental Licensing Division. These guidelines provide the fundamental framework for environmental management in offshore decommissioning activities (Brazilian Institute of Environment and Renewable Natural Resources - IBAMA, 2019).

Environmental policy in Brazil is centralized at the federal level, which limits the capacity of states and municipalities to legislate on secondary matters. The decommissioning process must strictly follow the standards and guidelines established by national regulatory bodies, such as the National Petroleum Agency (ANP), IBAMA, the Brazilian Navy, and the National Energy Commission (CNEN). Each of these agencies has its own legal policies for managing the decommissioning of installations, reflecting their specific responsibilities and competencies. The regulatory aspects of decommissioning must consider that it involves a set of activities that fall under different normative spheres, resulting in overlapping requirements related to authorizations and licensing (Brazilian Institute of Oil, Gas, and Biofuels - IBP, 2017; Steenhagen, 2020; Proença & Santos, 2023). Table 2 presents the applicable regulatory standards for this subject.

Table 2

Offshore Decommissioning Regulations in Brazil.

Applicable National Regulations	Description
Law No. 9,478/1997	Establishes Brazil’s National Energy Policy, regulating the oil and gas sector, including offshore decommissioning.
Resolution No. 1, January 23, 1986	Defines basic criteria and general guidelines for environmental impact assessment, with emphasis on the definition of environmental impact.
Law No. 9,605/1998	Specifies penalties for criminal and administrative offenses resulting from activities harmful to the environment, including decommissioning actions.

Law No. 9,966/2000	Regulates the prevention, control, and supervision of pollution caused by oil spills and other harmful or dangerous substances.
Complementary Law No. 140/2011	Establishes rules for cooperation between the federal government, states, the federal district, and municipalities in the environmental protection and decommissioning actions.
MMA Ordinance No. 422/2011	Specifies procedures for environmental licensing for oil and gas exploration and production activities in marine environments.
IMO Resolution A.672(16), 1989	Establishes guidelines and standards for the removal of offshore installations and structures from the continental shelf and exclusive economic zone.
Decree-Law No. 4,136/2002	Regulates penalties for violations of rules on the prevention, control, and supervision of pollution caused by oil and other harmful substances in waters under national jurisdiction.
Law No. 8,617/1993	The "Law of the Sea," which also includes a framework for offshore decommissioning.
Law No. 6,938/1981	Defines Brazil's National Environmental Policy, aiming at environmental preservation, improvement, and recovery.
Law No. 12,351/2010	Regulates the sharing of oil production from Brazil's pre-salt reserves, including aspects related to offshore decommissioning.
Resolution No. 23/1994	Regulates protected ecosystems for environmental conservation, impacting offshore decommissioning areas.
Resolution No. 237/1997	Applies the principles of Complementary Law No. 140/2011, focusing on environmental licensing for offshore decommissioning.
Law No. 12,305/2010	Establishes the National Solid Waste Policy (PNRS), applicable to waste management during decommissioning.
IBAMA No. 3642, 10/2018	Defines the National Plan for the Prevention, Control, and Monitoring of Coral Reefs, relevant to offshore decommissioning areas.
IBAMA Normative Instruction No. 28/2020	Provides guidelines for the environmental licensing of projects converting offshore platforms into artificial reefs.
CNEN-NN-8.02	Regulates the licensing of low- and medium-level radioactive waste, when applicable in the offshore sector.
NORMAM-07/DPC	Establishes norms for naval inspections of offshore installations, regulating the removal of platforms.
NORMAM-08/DPC	Regulates the traffic and stay of vessels in Brazilian jurisdictional waters, affecting decommissioning operations.
Resolution CNEN No. 288/2021	Defines requirements for cleaning and conditioning radioactive waste from oil and gas activities in offshore areas.
CNEN-NN-5.01	Regulates the safe transportation of radioactive materials, including offshore operations.
INI MD/MMA No. 2/2016	Regulates the export of ship hulls for dismantling, applicable to offshore structures.
ANP Resolution No. 43/2007	Establishes the Operational Safety Regime for Oil and Gas Installations (P&P) offshore.
ANP Resolution No. 41/2015	Regulates the Safety Management System for Subsea Systems and the decommissioning of pipelines and subsea systems.
ANP Resolution No. 46/2016	Defines the Well Integrity Management System (SGIP) in the context of decommissioning.
ANP Resolution No. 817/2020	Establishes specific regulations for offshore and onshore decommissioning.
ANP Resolution No. 854/2021	Regulates financial guarantees for covering the costs of decommissioning offshore installations.
Adoptable International Laws	
International Laws	**Description**
IMO Resolution A-672	Provides guidelines for the removal of offshore installations and structures from the continental shelf and the Exclusive Economic Zone (EEZ).
UNCLOS 1982 (United Nations Convention on the Law of the Sea)	Defines rights over marine resources and territorial waters, including regulations for the removal of decommissioned offshore installations.
IMO Resolution A672(16)	Regulates the complete or partial removal of offshore platforms, emphasizing environmental protection and marine safety.

OSPAR Convention	Establishes rules for environmental recovery and the sustainable management of waste and hazardous substances from offshore installations.

Source: Author's elaboration based on data from IBAMA (2019) and ANP (2020).

3.2.1 Adjustments According to International Standards

The Brazilian regulations are aligned with the best international sustainability practices for decommissioning (Destri et al., 2018; ANP, 2020; Steenhagen, 2020; TCU, 2021; Delgado, Moura, & França, 2021). These authors argue that, despite persistent challenges, Brazil has made significant progress in its regulatory framework, with continuous improvements in legislation in recent years. The legal policy seeks to address these challenges and explore opportunities in decommissioning (Santos, Santos, & Silva, 2022).

Brazil's maritime regulations are intrinsically linked to the international conventions to which the country is a signatory, such as UNCLOS, IMO, the London Protocol, and MARPOL (Higa, 2020). These conventions have been incorporated into the decommissioning program, as well as the 2009 Hong Kong Convention, which addresses the proper dismantling of ships, although Brazil has yet to sign this latter convention (Destri et al., 2018).

UNCLOS defines the rights and responsibilities of states over the oceans, including the responsibility for removing platforms and infrastructure that may cause marine ecological degradation, directly impacting offshore decommissioning. The IMO, founded in 1975, aims to control ocean pollution and prevent the dumping of waste and harmful substances. Similarly, the London Protocol (1996) prohibits the disposal of waste at sea, except for those previously listed as accepted and under specific conditions (IMO, 2016). The protocol entered into force in 2006, and Brazil is a signatory to these international maritime agreements.

The IMO has specific guidelines for the decommissioning and removal of structures from the continental shelf and the Exclusive Economic Zone (EEZ), with implementation monitored by the Brazilian Navy (Marinha, 2020). MARPOL regulates the prevention and control of marine pollution from vessels, playing a crucial role in the protocols for handling hazardous waste, such as hydrocarbons and toxic substances, preventing water contamination.

Law No. 9,966/2000 establishes guidelines for waste management and pollution control, including oil spills in Brazil's territorial sea. This law complements the provisions of MARPOL, reinforcing international maritime standards (IBAMA, 2019).

3.2.2 Degree of Applicability of Regulations

Although the topic of decommissioning in Brazil is recent, its importance has grown significantly due to the drop in oil barrel prices, the expiration of concession contracts, and the obsolescence of some operational units (Destri et al., 2018). According to Pinheiro and Monteiro (2023), many production fields are at the end of their useful life, with some already depleted or with production nearing economic infeasibility, which demands decommissioning actions. However, decommissioning in Brazilian waters faces challenges, mainly due to the high costs involved, as well as other technical and operational aspects (Castro et al., 2021; Marcio et al., 2023).

According to an EIA (2022) report, Brazil is the largest oil producer in South America. Regarding projected decommissioning costs, Brazil ranks third globally, behind only the UK and the US. Between 2019 and 2028, the country will be responsible for a significant portion of the total decommissioning costs (Wood Mackenzie, 2021).

Despite being the largest oil market in South America, with over 50% of its infrastructure installed for more than 25 years, as pointed out by Offshore Network research (2023), decommissioning in Brazil has not advanced at the desired speed due to inefficient legislation. Legal and technical aspects are being incorporated based on lessons learned from the North Sea (Souza, 2022; Kowarski & Rosado, 2023).

Decommissioning options include complete removal, partial removal, in situ decommissioning (maintenance of the installation or removal of the topside with the sinking of the legs), and offshore relocation. All these options are accepted by the competent authorities (PETROBRAS, 2016; Michalowski, 2022). Partial removal, the creation of artificial reefs, and the reuse of platforms for offshore wind farms are sustainable solutions that align with decarbonization and circular economy principles. However, their feasibility depends on detailed studies (PETROBRAS, 2016).

The regulation and oversight of decommissioning in Brazil are structured to divide responsibilities among specialized institutions, ensuring that each acts in accordance with its legal competences in operations, the environment, social responsibility, and the management of radioactive waste. According to IBP (2017) and ANP (2020), although the regulations are specific, there are recommendations for adjustments to make them more robust and effective.

In 2020, the Brazilian government proposed the creation of artificial reefs along the Brazilian coast in environmentally protected areas approved by the Brazilian Navy. The legislation for the creation of these reefs can be found in IBAMA’s Normative Instruction No.

22, dated July 10, 2009, which provides guidelines for the environmental licensing necessary for the installation of these reefs. This regulation was renewed by Normative Instruction No. 28/24/2020 (IBAMA, 2020).

Brazil has implemented specific norms for the creation of artificial reefs, which have significantly contributed to marine biodiversity with successful results (Cardoso et al., 2024). A notable example is the creation of artificial reefs on the coast of the state of Rio de Janeiro, which aims to assess their use for enhancing fishing activities (Zalmon, 2013).

It is recognized that the creation of artificial reefs in Brazil has advanced its contribution to marine ecosystems (Seixas, Barreto, & Santos, 2013). Brazilian reefs are unique due to the combination of high endemism, low coral species richness, high sedimentation rates, and moderate turbidity (Leão, Kikuchi, Ferreira, Neves, Sovierzoski, Oliveira, Maida, Correia, & Johnsson, 2016; Soares et al., 2021). They represent a singular habitat that promotes marine biodiversity in the world's oceans (Leão et al., 2016; Araújo, Mattos, Melo, Chaves, Feitosa, Lippi, et al., 2020). The policy of creating artificial reefs is a legal obligation recommended by the IMO (IMO, 2016).

Furthermore, these regulations assist in controlling invasive species, such as the coral-sol, in managing naturally occurring radioactive materials (NORM) (Smith et al., 2010), and include financial regulations (ANP, 2020). ANP Resolution No. 817/2020 requires operators to present a Decommissioning Program (PDI) aligned with the 17th Sustainable Development Goal (SDG) of the United Nations (UN) (ANP, 2020). Regarding technical options for offshore dismantling, ANP permits both partial removal and in situ retention of platforms, according to the guidelines established in ANP Resolution No. 817/2020. The operator must submit a project to ANP five years in advance for complete removal or three years for partial removal. The guidelines require clear proposals comparing different options considering a wide range of technical, environmental, social, and economic criteria. Partially removed or in situ platforms must not interfere with navigation or the marine environment without detailed justification (ANP, 2020). After dismantling, the seabed must be thoroughly cleaned by removing non-biodegradable materials within a radius of up to 500 meters from the platforms. For pipelines and umbilicals, a minimum distance of ten meters must be respected to avoid environmental effects (ANP, 2020).

According to Braga et al. (2022) and Santos, Santos, and Silva (2022), the diverse presence of sectors involved in the decommissioning process creates ongoing challenges. The management of NORM waste and the complexity of executing this process are significant obstacles. The ISO regulation (2019) establishes that all structures must be transported to designated locations or, if left in place, must be adequately cleaned (Braga et al., 2022). The Hong Kong Convention also sets guidelines for sustainable dismantling. Therefore, the remediation of areas contaminated by NORM after the removal of platforms is mandatory, as pointed out by Macintosh et al. (2022).

In Brazil, the management of coral-sol and NORM waste during decommissioning is an increasing challenge driven by the growing number of platforms and the insufficient infrastructure for treating and recycling these materials (Destri et al., 2018; Proença-Santos, 2020). The new CNEN Resolution No. 288/2021 establishes requirements for the cleaning of NORM waste and radioactive waste (GRUPO DE PESQUISA DESCOMSUB. SEMINÁRIO, 2024).

With the support of the new specific ANP Resolution No. 817/2020, efforts are being made to ensure that decommissioning is safe, minimizes environmental impacts, and strengthens governance and Brazil's commitment to sustainability. This also facilitates the expansion of operations related to oil and biofuels (ANP, 2020).

However, despite regulatory efforts to implement the best possible practices in offshore decommissioning in Brazil, conflicts arise due to the divergence between the interests of operators—who prioritize profitability—and regulatory agencies—who prioritize environmental safety and compliance with legal requirements. These conflicts result in tensions among the sectors involved in the decommissioning process (Teixeira & Machado, 2012; TCU, 2021; Alves De Souza et al., 2022). Although PETROBRAS adopts best international practices, TCU (2021) identified shortcomings in the Brazilian decommissioning process. Among these shortcomings are the lack of proper plans for the management and continuous monitoring of operations. This can cause negative impacts on marine life, as some parts of the infrastructure have been removed while other submerged structures remain without proper environmental oversight.

4 CONCLUSIONS

After analyzing the regulatory frameworks for decommissioning in both territories, it is concluded that Brazilian regulations are almost aligned with international best practices, although they present distinct regulatory milestones in legal policies.

UK legislation, on the other hand, is more advanced and widely applied, favoring not only energy policies but also marine conservation. This legislation encompasses various legal frameworks and comprehensive regulations that protect the different sectors involved in the process. In practice, UK law allows the reuse of structures for the installation of offshore wind farms, promoting renewable energy and the creation of artificial reefs that encourage the growth of marine ecosystems.

In Brazil, energy legislation has made significant progress by adopting international best practices and establishing specific regulatory frameworks to address the complex aspects of decommissioning. The country implements policies for the creation of artificial reefs, a recent practice that positively contributes to marine biodiversity. However, it still faces challenges in management, such as continuous control and monitoring, which limits its effectiveness due to political pressure. While the UK favors the creation of artificial reefs and the conversion of platforms into offshore wind farms, there are still gaps in the execution of these initiatives, preventing their full potential from being realized in the control and monitoring of converted platforms. This issue refers to the significant attention given to Brazil due to regulatory decisions on decommissioning, which are often contradictory between the parties involved.

Despite the solid and distinct legal framework in both countries, the implementation of regulatory standards still generates uncertainties and controversies regarding supervision and management during and after decommissioning.

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