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XVI CONGRESSO BRASILEIRO DE ENGENHARIA DE PRODUÇÃO
EVENTO ON-LINE
02 a 04 de dezembro de 2026
Inovação e Transformação Digital como Estratégia Competitiva nas Engenharias

Corporate Risk Disclosure and Asset Management in Brazil's Oil and Gas Sector: A Longitudinal Analysis Through the Lens of ISO 55001:2024

Helton Luiz Santana Oliveira
School of Engineering, Fluminense Federal University (UFF), Brazil
Gilson Brito Alves Lima
School of Engineering, Fluminense Federal University (UFF), Brazil

Abstract

Corporate risk disclosure in the oil and gas sector must address operational hazards, financial exposure, governance, and emerging environmental and social concerns. This article examines how Petrobras classified the risks disclosed in its annual reports and Form 20-F filings from 2020 through 2024. It asks how the company's risk taxonomy changed and whether the revised disclosure is conceptually consistent with ISO 31000, COSO ERM, and ISO 55001. A systematic documentary comparison identified the categories used in each year, examined the stated regulatory rationale for the 2022 revision, and mapped the resulting categories against those frameworks. The findings show a shift from three broad groups—operational, financial, and compliance/legal/regulatory risks in 2020–2021—to thirteen thematic categories in 2022–2024, including climate, social, environmental, governance, and reputational risks. The structure remained broadly stable during 2023–2024. The broader taxonomy improves the visibility of material exposures and is conceptually compatible with integrated risk management. Because the evidence consists of public disclosures, however, the study cannot establish whether internal risk controls or organizational maturity improved.

Keywords: Asset Management, Corporate risks, Oil and gas, Enterprise risk management.

1. Introduction

Petroleum and natural gas companies face interconnected technical, financial, regulatory, environmental, social, and geopolitical exposures. Their disclosure of material risks matters to investors and other stakeholders because it reveals how a company describes uncertainties that may affect its strategy, operations, assets, and financial performance. The usefulness of such disclosure depends on its scope, clarity, and comparability over time.

This study examines Petrobras's risk-factor disclosures from 2020 through 2024. In particular, it investigates the transition from three broad risk groups to thirteen thematic categories introduced in 2022 under the Brazilian Securities and Exchange Commission (Comissão de Valores Mobiliários, CVM) reporting structure. The research problem is whether this change represents a more informative architecture of risk disclosure and how the new categories relate to international risk-management and asset-management frameworks. The study also considers the relationship between the U.S. Securities and Exchange Commission (SEC) Form 20-F and the Brazilian classification, without treating conceptual similarity as proof of regulatory compliance.

The objective is to compare the annual taxonomies, identify the documented reason for the 2022 revision, and assess their conceptual relationship with ISO 31000:2018, COSO ERM, and ISO 55001:2024. A systematic documentary analysis of the annual reports and Form 20-F filings supplies the evidence, following established principles of documentary social research (Bryman, 2016). The next section presents the reporting context; Section 3 explains the method; Sections 4 and 5 report and discusses the findings; and Section 6 sets out the conclusions and limitations.

2. Reporting Context and Analytical Framework

The SEC requires foreign private issuers with securities traded in the United States to file an annual report on Form 20-F (SEC, 2024). The filing addresses business activities audited financial statements under recognized accounting standards (IFRS Foundation, 2023), management's discussion and analysis, internal controls, governance, and material risk factors. These disclosures provide investors with information about financial, operational, legal, technological, and environmental exposure. For oil and gas companies, process safety and major-accident hazards are also relevant to the assessment of material operating risks (CCPS, 2019).

As a Brazilian issuer with access to international capital markets, Petrobras uses its annual reporting and Form 20-F disclosures to communicate exposures such as commodity-price volatility, regulatory obligations, operational safety events, environmental liabilities, and the energy transition (Petrobras, 2025). The risk-factor sections therefore provide a basis for comparing both classification and reporting emphasis over successive fiscal years. They cannot, by themselves, demonstrate the effectiveness of internal controls.

ISO 31000:2018 describes principles and a framework for integrating risk management into governance, decision-making, and organizational processes (ISO, 2018). COSO's Enterprise Risk Management framework connects risk to strategy, performance, governance, review, and information flows (COSO, 2017). ISO 55001:2024 establishes requirements for an asset management system that supports the realization of value from assets and the management of related risks and opportunities (ISO, 2024). These three documents serve here as interpretive lenses rather than audit criteria; resemblance between a disclosure taxonomy and a framework is not evidence of certification or conformity.

2.1. Why the reporting regimes matter

The U.S. Form 20-F and the Brazilian disclosure framework address different regulatory audiences and cannot be reduced to a single checklist. Form 20-F is relevant because Petrobras reports to U.S. capital markets, whereas the CVM's reporting structure shapes the categorization presented to Brazilian investors. A comparison must therefore distinguish the presence of a material risk in a filing from the heading under which that risk is organized. A risk may remain substantively described even when a year-to-year change in taxonomy makes the heading appear new. Conversely, the addition of a heading does not establish that the company has implemented a new risk control.

The original study describes three layers of relevance. The first is the issuer's technical and operating exposure: production, refining, transportation, process safety, projects, suppliers, and the reliability of critical assets. The second is the financial and strategic environment: commodity prices, foreign exchange, credit, financing, portfolio allocation, and the role of the controlling shareholder. The third is the institutional environment: legal compliance, regulatory decisions, climate transition, environmental obligations, community relations, and the company's reputation. These layers overlap. For example, an operating accident can generate environmental losses, litigation, financing pressure, and reputational consequences. A thematic taxonomy may make these interfaces more explicit, although it can also duplicate a single causal chain across several categories.

The analysis of disclosure has particular relevance for asset-intensive industries. An investment in an offshore production system can depend simultaneously on supplier performance, environmental permits, reservoir uncertainty, financing conditions, and the adequacy of operational barriers. An integrated risk narrative can clarify these dependencies for stakeholders. Whether such integration is practiced in asset planning, maintenance, and operational decisions requires a different empirical design from the one used in this paper.

3. Method

A longitudinal documentary analysis examined the risk-factor sections of Petrobras's annual reports and Form 20-F filings for fiscal years 2020, 2021, 2022, 2023, and 2024 (Petrobras, 2021, 2022, 2023, 2024, 2025). The unit of analysis was the explicit category used to organize a material risk disclosure. The procedure had three stages: extraction of category labels and definitions for each year; comparison of the number, scope, and organization of the categories; and interpretation of the stated rationale for the structural revision introduced in the 2022 report.

The first stage identified a stable tripartite classification in 2020 and 2021: operational risks; financial risks; and compliance, legal, and regulatory risks. The second stage documented Petrobras's statement that it changed the structure of risk factors to accommodate the CVM's required order of relevance in 2022 (Petrobras, 2023). The revised presentation was organized into thirteen categories concerning the issuer, shareholders, managers, suppliers, customers, economic sectors, industry regulation, foreign countries, social issues, environmental issues, climate issues, brand use, and shares and debt securities. The third stage examined whether the same top-level structure appeared in 2023 and 2024.

A comparative matrix was then developed to relate the disclosed categories to concepts in ISO 31000, COSO ERM, and ISO 55001. The assessment is qualitative. The labels “high” and “very high” in Exhibit 1 summarize the authors' judgment about thematic correspondence; they are not standardized scores, empirical measures of risk-management performance, or findings from an independent compliance audit. Causal interpretation is limited to the regulatory rationale explicitly stated in the reports. Other organizational drivers cannot be established from public documents alone.

3.1. Comparison rules and interpretive limits

For each reporting year, the analysis recorded the number and names of top-level categories and compared their stated or implied subjects. A category was treated as stable when it retained the same general heading and substantive domain in successive documents. The transition year was identified by the first report in which the new set appeared. The analysis focuses on the reporting architecture; it does not count the frequency of particular risk words as a proxy for likelihood or severity. Nor does it assume that longer disclosures are inherently more accurate or useful. Documentary statements about the rationale for change were distinguished from the authors' interpretations of broader governance implications.

The crosswalk uses a qualitative correspondence rule. A Petrobras disclosure topic was associated with a framework element when both concerned the same managerial issue, such as leadership, context, strategy, information, or asset-related planning. “High” indicates an evident thematic connection, while “very high” denotes a broader or more direct overlap in the published taxonomy. These judgments are deliberately descriptive: no weights, thresholds, inter-rater reliability estimates, or external validation were available in the source study. They should not be interpreted as quantitative ratings of ISO compliance, ERM maturity, or the effectiveness of Petrobras's controls.

4. Results

4.1. The 2020–2021 classification

The reports for 2020 and 2021 used the same three broad categories (Petrobras, 2021, 2022). Operational risks covered the company's activities and potential failures or deficiencies in internal processes, goods and services, systems, natural events, and third-party actions. Relevant exposures included industrial accidents, leaks, fires, explosions, pipeline interference, occupational and environmental events, operational interruptions, and workforce issues.

Financial risks covered market fluctuations, counterparty default, and mismatches between assets and liabilities. They included oil and product prices, foreign exchange, interest rates, debt, liquidity, credit, cash flow, profitability, and macroeconomic conditions. Compliance, legal, and regulatory risks related to the failure to comply with applicable law, regulations, or internal requirements and included fraud, corruption, money laundering, litigation, investigations, internal controls, differing legal interpretations, and environmental, health, safety, and tax obligations. The three headings remained structurally unchanged across the two reporting years.

4.2. The 2022–2024 classification

Beginning with the 2022 report, Petrobras adopted a more detailed thematic structure aligned with the CVM's reporting requirements (Petrobras, 2023). The thirteen top-level categories were retained in the 2023 and 2024 reports (Petrobras, 2024, 2025). Their principal subjects are summarized below.

Risks related to the issuer concern Petrobras as an organization, including safety, health, environment, litigation, technology and cybersecurity, projects and investment, liquidity and debt, taxation, reserves, decommissioning, actuarial liabilities, labor issues, insurance, internal controls, corruption investigations, and data protection. Shareholder risks, particularly those concerning the controlling shareholder, include the potential influence of federal government objectives on fuel pricing, investment, strategy, and dividends. Manager-related risks address fraud, bribery, corruption, misconduct, and deficiencies in ethical compliance.

Supplier risks include delays or failures in essential goods and services, technical capacity, global supply chains, pandemics, geopolitical conflicts, and the complexity of floating production, storage, and offloading (FPSO) projects. Customer risks concern credit, default, and circumstances that may require continued supply to customers in arrears. Risks related to the economic sectors in which Petrobras operates include oil and gas prices, competition, Brazilian macroeconomic conditions, geopolitical uncertainty, exchange rates, interest rates, portfolio decisions, and impairment.

Industry-regulation risks arise from sector agencies and other authorities, including local-content requirements, decommissioning, environmental licensing, and differing interpretations of applicable rules. Foreign-country risks concern political, economic, and social instability in countries where the company operates, including nationalization, price controls, currency fluctuations, and contractual restrictions. Social risks address community relations, human rights, violence, sabotage, theft, and opposition to operations or decommissioning, with possible consequences for schedules, cost, reputation, and continuity.

Environmental risks concern stricter or differently interpreted health, safety, and environmental requirements, with potential consequences for cost, production, licensing, and litigation. Climate risks include physical events and transition risks associated with regulation, markets, and the need to invest in mitigation and adaptation. Brand-related risks

concern the potential reputational effects of accidents, investigations, court rulings, and social or environmental conflicts. Risks related to shares and debt securities include price volatility, liquidity, investor perceptions, credit ratings, and market conditions affecting issued securities.

The observed change is a change in the public organization of risk factors. It broadens the visibility of categories that were previously subsumed under wider headings. The documentary evidence does not show that the underlying exposures were absent before 2022 or that their probability or impact necessarily changed when the taxonomy changed.

4.3. What changed—and what did not follow automatically

The break between the 2021 and 2022 reporting cycles is visible in the number and logic of the top-level categories. Before the revision, an investor had to look within broad operational, financial, or compliance headings to locate a particular environmental, climate, governance, or geopolitical exposure. After the revision, several of those themes acquired their own place in the risk-factor architecture. This is a material change in discoverability and presentation even where the underlying narrative or economic exposure may have continued across years.

The thirteen-category structure is not a ranking of thirteen mutually exclusive hazards. Several categories can refer to the same event through different consequences or stakeholder relationships. A pipeline accident, for example, could be discussed as an issuer-related operating exposure, an environmental liability, a social issue affecting communities, a regulatory issue, and a brand risk. Reading the categories as separate independent events would overstate the number of distinct initiating hazards. The categories are best understood as a reporting taxonomy that organizes different dimensions of material exposure.

Likewise, the word “dominant” in the title refers to risk themes prominent in this Petrobras case and in this case study's interpretive framework. The study does not estimate sectorwide frequencies or severities, and the Petrobras filings alone cannot identify a definitive ranking for all Brazilian oil and gas companies. The observed stability of the revised headings in 2023 and 2024 supports a conclusion about continuity of disclosure format. It cannot establish the stability of risk levels, the accuracy of internal assessments, or the effectiveness of responses to emerging threats.

5. Discussion

5.1. Longitudinal interpretation and ISO 31000

The reports reveal two distinct phases: a functional classification in 2020–2021 and a thematic classification with thirteen categories in 2022–2024. The 2022 revision increased the specificity with which Petrobras described governance, environmental, social, climate, reputational, and geopolitical exposure. Its continuation over the following two reporting years indicates stability in the published presentation. This is a disclosure-level observation and should not be equated with evidence of organizational learning or improved control performance.

The revised taxonomy is conceptually consistent with the integrated, structured, contextual, and dynamic approach described in ISO 31000 (ISO, 2018). A wider range of explicitly named exposures may improve communication with investors and facilitate discussion across business units. Nevertheless, the number of headings is not itself a measure of integration: evaluation of risk ownership, monitoring quality, and treatment effectiveness would require information beyond the reports examined here.

5.2. COSO ERM and the comparative matrix

COSO ERM emphasizes governance and culture; strategy and objective-setting; performance; review and revision; and information, communication, and reporting (COSO,

2017). Categories addressing managers, shareholders, and the brand relate to governance and culture. Categories concerning economic sectors, climate, regulation, and foreign countries make strategic exposures more visible. A more detailed taxonomy can also assist risk identification and investor communication. These conceptual links do not establish that all COSO components are implemented effectively within Petrobras.

Exhibit 1 compares the framework concepts with the Petrobras disclosure structure. The qualitative alignment judgments reflect breadth and thematic correspondence in public reporting, without constituting a test of internal practice.

Exhibit 1 – Comparison of ISO 31000, COSO ERM, and disclosed risk categories (2022–2024)

Dimension	ISO 31000:2018	COSO ERM 2017	Petrobras disclosure	Correspondence
Core purpose	Create and protect value; support decisions and governance.	Integrate risk with strategy and performance.	Thirteen categories covering strategy, operations, ESG, regulation, reputation, and finance.	High
Key principles	Integrated, structured, tailored, inclusive, informed, dynamic, and improving.	Governance, culture, strategy, performance, communication, and reporting.	More granular, CVM-aligned and oriented toward investor communication.	High
Risk governance	Leadership commitment and cross-functional integration.	Governance and culture as a core component.	Separate categories for managers and the controlling shareholder.	High
Scope	Systemic and organization-wide perspective.	Interdependent governance, strategy, performance, and information.	Issuer, shareholders, ESG, climate, regulation, suppliers, customers, and brand.	Very high
Stakeholders	Engagement, communication, and inclusion.	Communication, reporting, and culture.	Explicit relevance to investors, regulators, communities, and the market.	Very high
Identification	Systematic and contextualized process.	Prioritization in relation to objectives.	Three broad groups in 2020–2021; thirteen themes in 2022–2024.	Very high
Emerging risks	Continual monitoring.	Strategic and long-term exposures.	Climate, social, cyber, and reputational risks expressly identified.	Very high
Strategy	Connection with objectives and context.	Strategy and objective-setting component.	Sectoral, foreign-country, regulatory, climate, and financial-market categories.	High
Transparency	Clear and continual communication.	Information, communication, and reporting.	CVM structure adds specificity to investor-oriented risk reporting.	Very high
ESG	Relevant to protecting value.	Relevant to internal and external assessment.	Distinct environmental, social, climate, and brand categories.	Very high
Portfolio view	Integration of multiple risk sources.	Cross-functional perspective.	Operating, strategic, financial, regulatory, geopolitical, and social exposures.	Very high
Regulation	Nonprescriptive but compatible with governance.	Compatible with reporting and control practices.	Reorganization explicitly associated with the CVM-required order of relevance.	High

Source: Authors' interpretation of ISO (2018), COSO (2017), and Petrobras (2023–2025).

Enterprise risk management is intended to consider exposures across functions and their implications for value. The revised presentation encompasses operations, finance, regulation, climate, social issues, and reputation, and thus offers a wider view of the disclosed risk portfolio. Its value for decisions depends on whether such information is also integrated into internal evaluation, prioritization, and treatment. The examined documents do not permit this further inference.

5.3. Implications for ISO 55001:2024

ISO 55001:2024 requires an asset management system to address organizational context, leadership, planning, support, operation, performance evaluation, and improvement (ISO, 2024). The expanded risk taxonomy has conceptual links to these areas, particularly where external conditions, stakeholder expectations, life-cycle decisions, and asset-related risks interact. The standard does not prescribe a particular list of corporate risk categories, and a company's published taxonomy cannot demonstrate conformity with its requirements.

Clause 4 concerns organizational context and interested parties. The explicit disclosure of sectoral, geopolitical, climate, social, regulatory, shareholder, and reputational exposures can inform such contextual analysis. Clause 5 addresses leadership and the alignment of responsibilities and policy; the categories related to managers, shareholders, governance, and internal controls are relevant to that conversation. Clause 6 concerns planning for risks and opportunities; a more granular classification may help identify matters that require assessment and treatment, including longer-term climate and transition exposure.

Clauses 7 and 8 concern support and operation. Supplier, customer, issuer, and regulatory risks may affect resources, competence, the supply chain, operational controls, and asset life-cycle decisions. Clause 9 requires performance evaluation, but annual repetition of disclosure categories does not prove that risk indicators were monitored or that reviews were effective. Clause 10 addresses improvement; stability of reporting from 2022 through 2024 is not, on its own, evidence of continuous improvement. Evaluation against these clauses would require process records, decisions, controls, and results.

The broadened categorization also helps articulate how assets generate and preserve value under financial, safety, environmental, and social constraints. This is relevant to asset management because decisions over an asset's life cycle involve performance, cost, risk, and opportunity. The relationship identified here remains an analytical correspondence between public reporting and the themes of ISO 55001, rather than a conclusion about Petrobras's asset management system.

5.4. Governance implications and research boundaries

From a governance perspective, the revised classification can provide a clearer route from a risk statement to the stakeholder or decision domain it affects. Categories concerning shareholders and managers draw attention to decision rights and incentives. Supplier and customer categories foreground dependencies beyond the issuer's direct operating assets. Environmental, social, and climate categories clarify exposures that may unfold over longer horizons than a single reporting period. Brand and securities categories make explicit how operating or governance events can affect market confidence and financing. These are plausible uses of the information, rather than demonstrated effects of the 2022 revision.

The distinction between reporting and risk management is essential. ISO 31000 addresses the design and operation of risk processes, while COSO ERM links risk with strategy and performance. ISO 55001 concerns an actual management system and the realization of value from assets. None can be verified solely by counting public disclosure headings. An assessment of implementation would need evidence about assigned risk owners, decision records, acceptance criteria, performance indicators, assurance activities, and whether corrective actions changed outcomes. Interviews and internal documentation could complement the documentary record, subject to access and confidentiality.

The original manuscript also connects the expanded taxonomy to environmental, social, and governance concerns. The connection is credible at the level of explicit reporting categories, but an ESG heading can coexist with weak mitigation, and the absence of a distinct heading in an earlier year does not prove that a risk was ignored. The longitudinal comparison should therefore be interpreted as evidence of a change in public framing. A future comparative study could code the substantive disclosures under each heading, distinguish recurring from newly disclosed exposures, and compare Petrobras with peer companies under similar reporting rules. A subsequent market study could test whether the revision altered investors' understanding rather than assuming that greater detail necessarily produced greater transparency in practice.

5.5. Interpreting the thirteen categories across the asset life cycle

The disclosure categories can be read alongside the main stages of asset decisions, while respecting the difference between corporate reporting and operational risk analysis. During project selection and design, exposures concerning economic sectors, climate policy, finance, reserves, permits, and the controlling shareholder may influence the allocation of capital and the assumptions underlying a business case. Supplier capability and market conditions become critical in procurement and construction. During operation, safety and environmental performance, cybersecurity, reliability, workforce capability, and customer obligations may affect the ability to deliver intended services. During decommissioning,

financial provisions, environmental licensing, community expectations, and legal duties remain relevant after production ends. This life-cycle interpretation helps explain why a purely operational risk group cannot convey every relationship among an asset, its stakeholders, and the value it is expected to generate.

Some categories describe sources of uncertainty, others describe affected parties or consequences. Climate events may be a physical source of interruption; transition policy may change the commercial context; a supplier category identifies a dependency; a brand category identifies a potential consequence for reputation. This mixture of organizing principles is useful for disclosure to diverse audiences, but it presents a methodological challenge for comparison and aggregation. An analyst should avoid adding up category counts as though each represented a separate, independent risk. Meaningful portfolio evaluation would require explicit scenarios, causal pathways, dependencies, time horizons, and common criteria for assessing severity and likelihood. Those elements are not produced by the category labels themselves.

The apparent expansion from three to thirteen headings should also be interpreted with attention to continuity. Operating risks in the earlier classification already included accidents, service interruptions, and third-party events. Financial risks already encompassed prices, liquidity, and credit. Compliance risks already covered litigation and regulation. The later structure makes particular dimensions easier to identify and compare but does not mean that Petrobras first encountered climate, social, or governance exposure in 2022. Establishing when a specific exposure was first recognized would require a content-level examination of every annual narrative, beyond the top-level comparison presented here.

The public-company setting further shapes interpretation. A risk factor is drafted for securities disclosure and may emphasize uncertainties material to investors; it is not equivalent to a technical hazard register, an enterprise risk inventory, or an asset management plan. For example, a process safety event may be disclosed through several investor-facing categories, while its operational control depends on hazard analysis, inspection, maintenance, emergency preparedness, and management of change. Likewise, climate transition can appear as a reporting topic while requiring separate strategic analyses of demand, regulation, technology, and capital allocation. The usefulness of the thirteen-category model therefore rests partly on how effectively each category links to decisions and evidence outside the filing.

A practical extension of this study would create a longitudinal coding protocol at the level of individual risk statements rather than headings alone. Each statement could be assigned a risk source, affected objective, asset-life-cycle stage, stakeholder group, stated consequence, and time horizon. Two independent reviewers could code the same material to assess reproducibility, and any disagreements could be resolved under documented rules. Such a design would distinguish an actual addition of information from a change in placement or wording. It would also support peer comparison without assuming that all issuers adopt the same regulatory taxonomy or that a greater volume of narrative means better governance.

6. Conclusions

This study examined changes in corporate risk disclosures in Brazil’s oil and gas sector through a longitudinal analysis of Petrobras’s annual reports and Form 20-F filings from 2020 to 2024. Its purpose was to assess how the published risk classification evolved and how that evolution relates to risk governance and the asset management perspective of ISO 55001:2024. The research compared the categories reported each year and interpreted them in light of ISO 31000, COSO ERM, and ISO 55001.

The principal finding is a structural change in 2022, when three broad risk groups were replaced by thirteen thematic categories that remained in use through 2024. The revised classification gives greater visibility to climate, environmental, social, governance, geopolitical, and reputational exposures. By mapping these categories to international frameworks, the study offers a basis for examining how disclosed risks may inform decisions across the asset life cycle.

The findings concern public reporting, not the effectiveness of internal risk controls or conformity with ISO 55001:2024. Because the analysis relies on published documents from one company, it cannot establish whether risk management performance improved or whether the same classification applies across the Brazilian oil and gas sector. Further research should examine internal decision processes and compare disclosures from other companies.

References

U.S. SECURITIES AND EXCHANGE COMMISSION (SEC). Form 20-F: Annual report requirements for foreign private issuers. Washington, DC: SEC, 2024.

INTERNATIONAL FINANCIAL REPORTING STANDARDS FOUNDATION (IFRS). IFRS Standards. London: IFRS Foundation, 2023.

CENTER FOR CHEMICAL PROCESS SAFETY (CCPS). Guidelines for risk based process safety. Hoboken: Wiley, 2019.

PETRÓLEO BRASILEIRO S.A. (PETROBRAS). Form 20-F annual report 2024. Washington, DC: SEC, 2025.

BRYMAN, A. Social research methods. Oxford: Oxford University Press, 2016.

PETRÓLEO BRASILEIRO S.A. (PETROBRAS). Form 20-F annual report 2020. Washington, DC: SEC, 2021.

PETRÓLEO BRASILEIRO S.A. (PETROBRAS). Form 20-F annual report 2021. Washington, DC: SEC, 2022.

PETRÓLEO BRASILEIRO S.A. (PETROBRAS). Form 20-F annual report 2022. Washington, DC: SEC, 2023.

PETRÓLEO BRASILEIRO S.A. (PETROBRAS). Form 20-F annual report 2023. Washington, DC: SEC, 2024.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO). ISO 31000:2018: Risk management — Guidelines. Geneva: ISO, 2018.

COMMITTEE OF SPONSORING ORGANIZATIONS OF THE TREADWAY COMMISSION (COSO). Enterprise risk management — Integrating with strategy and performance. New York: COSO, 2017.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO). ISO 55001:2024: Asset management — Asset management system — Requirements. Geneva: ISO, 2024.