


THE ROLE OF OIL COMPANIES IN IMPLEMENTING PAYMENTS FOR ENVIRONMENTAL SERVICES IN ANGOLA: CHALLENGES AND OPPORTUNITIES FOR SUSTAINABLE MANAGEMENT

O PAPEL DAS EMPRESAS PETROLÍFERAS NA IMPLEMENTAÇÃO DE PAGAMENTOS POR SERVIÇOS AMBIENTAIS EM ANGOLA: DESAFIOS E OPORTUNIDADES PARA UMA GESTÃO SUSTENTÁVEL

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Abstract

This article examines the feasibility, opportunities, and constraints associated with implementing Payment for Environmental Services (PES) mechanisms within Angola's oil sector, a strategic industry that generates significant environmental, social, and economic externalities. Using a qualitative, exploratory, and multi-method approach that includes structured literature review, document analysis, and comparative assessment of international PES experiences, the study evaluates PES as a governance instrument capable of promoting ecological restoration, carbon mitigation, biodiversity conservation, water resource protection, and community development. The findings indicate that PES can help mitigate oil-related impacts through reforestation programs, mangrove and coastal ecosystem restoration, watershed protection, marine conservation, and community-based livelihood initiatives, which enhance carbon sequestration, reduce land degradation, strengthen climate resilience, and improve socio-environmental outcomes for local populations. However, the successful implementation of PES in Angola requires addressing persistent legal and institutional gaps, strengthening monitoring, reporting, and verification

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(MRV) systems, preventing risks of corporate greenwashing, and improving coordination among governmental agencies, private operators, and local communities. The study concludes that PES represents a strategic opportunity for Angola to reinforce environmental governance, elevate corporate sustainability performance, and accelerate progress toward the Sustainable Development Goals (SDGs), particularly SDGs 6, 13, 14, and 15, which relate to water security, climate action, marine conservation, and terrestrial ecosystem protection, while also contributing to more transparent, inclusive, and performance-based environmental management practices in oil-producing regions.

Keywords: Payment for Environmental Services, Oil Sector, Environmental Governance, Sustainability, Angola, SDGs, Biodiversity, Marine Conservation, Environmental Indicators.

Resumo

Este artigo examina a viabilidade, as oportunidades e os constrangimentos associados à implementação de mecanismos de Pagamento por Serviços Ambientais (PSA) no sector petrolífero de Angola, uma indústria estratégica que gera externalidades ambientais, sociais e económicas significativas. Utilizando uma abordagem qualitativa, exploratória e multimétodos que inclui revisão estruturada da literatura, análise de documentos e avaliação comparativa de experiências internacionais de PSA, o estudo avalia o PSA como um instrumento de governança capaz de promover a restauração ecológica, a mitigação de carbono, a conservação da biodiversidade, a proteção dos recursos hídricos e o desenvolvimento comunitário. As conclusões indicam que o PSA pode ajudar a mitigar os impactos relacionados com o petróleo através de programas de reflorestação, restauração de mangais e ecossistemas costeiros, protecção de bacias hidrográficas, conservação marinha e iniciativas de subsistência baseadas na comunidade, que melhoram o sequestro de carbono, reduzem a degradação da terra, fortalecem a resiliência climática e melhoram os resultados socioambientais para as populações locais. No entanto, a implementação bem-sucedida do PES em Angola exige a resolução de lacunas jurídicas e institucionais persistentes, o reforço dos sistemas de monitorização, notificação e verificação (MRV), a prevenção dos riscos de lavagem verde corporativa e a



melhoria da coordenação entre agências governamentais, operadores privados e comunidades locais. O estudo conclui que o PES representa uma oportunidade estratégica para Angola reforçar a governação ambiental, elevar o desempenho da sustentabilidade corporativa e acelerar o progresso em direcção aos Objectivos de Desenvolvimento Sustentável (ODS), particularmente os ODS 6, 13, 14 e 15, que se relacionam com a segurança da água, a acção climática, a conservação marinha e a protecção dos ecossistemas terrestres, ao mesmo tempo que contribui para práticas de gestão ambiental mais transparentes, inclusivas e baseadas no desempenho nas regiões produtoras de petróleo.

Palavras-chave: Pagamento por Serviços Ambientais, Sector Petrolífero, Governação Ambiental, Sustentabilidade, Angola, ODS, Biodiversidade, Conservação Marinha, Indicadores Ambientais.

INTRODUCTION

Angola's economy remains structurally dependent on petroleum extraction, which has accounted for approximately 30-40% of national GDP, over 90% of export revenues, and more than 60% of fiscal income during the last decade, according to official statistics from the National Agency for Petroleum, Gas and Biofuels (ANPG) and the Ministry of Finance. While the oil industry has historically driven economic growth, its environmental and social impacts have become increasingly documented. Reports from the Ministry of Environment, the Environmental Impact Assessment System (SIAIA), and independent audits highlight recurrent challenges such as oil spills along the Cabinda and Zaire coastlines, gas flaring concentrations in Soyo, soil and groundwater contamination in onshore blocks, and pressures on sensitive ecosystems including mangroves and coastal wetlands. These impacts reveal persistent governance gaps and underscore the need for more effective environmental management instruments.

In this context, adopting innovative mechanisms capable of reconciling continued oil production with ecosystem protection and community well-being becomes essential. Payments for Environmental Services (PES) have emerged globally as a promising tool that compensates actors who conserve or restore ecosystems, aligning economic incentives with environmental outcomes. International



experiences, particularly in Latin America and Southeast Asia, demonstrate that PES can support reforestation, watershed protection, biodiversity conservation, and community-based natural resource management.

Despite its potential, PES remains underdeveloped in Angola, especially within the oil sector. The country possesses a robust environmental legal framework, including the Environmental Framework Law (Lei No. 5/98), the Environmental Impact Assessment Decree (Presidential Decree 117/20), the Coastal Zone Management Law (Lei 17/09), and the National Biodiversity Strategy, yet none of these instruments explicitly regulate or operationalize PES mechanisms. This legal gap, combined with institutional weaknesses such as limited monitoring capacity, fragmented governance, and insufficient enforcement, constrains the adoption of incentive-based conservation tools and increases the risk of superficial or symbolic implementation.

Strengthening PES in Angola's oil sector could enhance corporate ESG performance, improve transparency, and support national commitments to the Sustainable Development Goals (SDGs), particularly SDGs 6, 13, 14, and 15. However, doing so requires a clear understanding of the country's institutional realities, environmental pressures, and socio-economic dynamics.

This article examines the potential for integrating PES into Angola's oil sector, proposes a set of environmental, social, and economic indicators to evaluate its effectiveness, and offers recommendations for public policy and corporate sustainability strategies.

THEORETICAL FOUNDATIONS OF PAYMENTS FOR ENVIRONMENTAL SERVICES

Payments for Environmental Services (PES) have gained prominence as an innovative policy instrument that recognizes the economic, ecological, and social value of ecosystem services. These services, such as climate regulation, water purification, biodiversity conservation, and soil fertility, are typically undervalued or excluded from conventional market systems, resulting in persistent environmental externalities. PES mechanisms seek to correct these market failures by creating incentive



structures that reward actors who conserve, restore, or sustainably manage ecosystems, thereby aligning private decisions with socially desirable environmental outcomes.

CONCEPT AND EVOLUTION OF PES

Early conceptualizations of PES were strongly influenced by the economic definition proposed by Wunder (2005), who described PES as a voluntary, conditional transaction in which beneficiaries of ecosystem services compensate providers for maintaining or enhancing those services. This "purist" model emphasizes strict conditionality, measurable outcomes, and direct payments tied to environmental performance.

However, subsequent scholarship has expanded and problematized this definition. Muradian et al. (2010) argue that PES should be understood not merely as market transactions but as institutional arrangements shaped by power relations, governance structures, and socio-political contexts. Schomers and Matzdorf (2013) highlight that many real-world PES schemes deviate from the purist model, adopting hybrid or "pragmatic" designs that incorporate social objectives, community participation, and flexible conditionality, particularly in developing countries with limited monitoring capacity. Vatn (2014) further emphasizes that PES operates within broader governance systems, where cooperation, trust, and collective action often matter as much as financial incentives.

This evolution in the literature has led to a widely accepted distinction between: (a) Purist PES, characterized by strict conditionality, direct payments, measurable ecosystem outcomes, and strong monitoring systems; and (b) Pragmatic PES, more flexible, integrating social equity, community development, and institutional constraints, often used in contexts of weak governance or limited enforcement capacity.

For countries like Angola, where environmental governance faces challenges related to monitoring, enforcement, and institutional coordination, the pragmatic PES model is particularly relevant.



It allows for the integration of community-based approaches, co-benefits, and adaptive management while still promoting environmental outcomes aligned with national sustainability goals.

Recent literature (Wunder et al., 2018; Pattanayak et al., 2010) reinforces that successful PES implementation depends on clear institutional mandates, transparent benefit-sharing mechanisms, and robust Monitoring, Reporting and Verification (MRV) systems. These elements are essential for ensuring credibility, avoiding greenwashing, and generating measurable environmental improvements.

CORE PRINCIPLES

PES programs are typically grounded in three foundational principles: (a) **Additionality**, meaning environmental benefits must exceed what would occur without the intervention; (b) **Conditionality**, meaning payments depend on verified compliance with agreed-upon conservation actions; and (c) **Monitoring, Reporting, and Verification (MRV)**, where robust monitoring ensures transparency and accountability.

TYPES OF ENVIRONMENTAL SERVICES

PES initiatives commonly target: carbon sequestration and climate regulation; watershed protection and water quality improvement; biodiversity conservation and habitat restoration; and cultural and landscape services.

INTERNATIONAL EXPERIENCES

International experiences with Payments for Environmental Services (PES) reveal substantial variation in design, governance arrangements, and implementation outcomes. Countries such as Costa Rica, Brazil, Mexico, and Vietnam have developed large-scale PES programs that demonstrate the instrument's flexibility, but also highlight the institutional conditions required for success. In Costa Rica, the national PES program managed by FONAFIFO has been effective due to stable macroeconomic



conditions, a dedicated financing mechanism (fuel tax and water tariffs), clear legal mandates, and strong monitoring capacity. Brazil's experiences, particularly in states such as Espírito Santo (Programa Reflorestar) and Rio de Janeiro (Produtores de Água e Floresta), benefit from consolidated environmental institutions such as ICMBio, state environmental agencies, and geospatial monitoring systems that ensure verification and accountability.

In contrast, African experiences in Uganda, Kenya, and South Africa illustrate the potential of PES to support community-based natural resource management, but also expose challenges related to land tenure insecurity, limited funding, and weak monitoring systems. These programs often rely on hybrid or pragmatic PES models, emphasizing social co-benefits, community participation, and flexible conditionality, features particularly relevant for countries with governance constraints.

A critical analytical lens for comparing these experiences is the theory of policy transfer proposed by Dolowitz and Marsh (2000), which argues that successful transfer depends on the compatibility between the institutional, political, and socio-economic contexts of the "exporting" and "importing" countries. Applying this framework reveals that direct replication of Costa Rica's or Brazil's PES models in Angola would be limited by structural differences, including: institutional fragility, as Angola lacks consolidated agencies equivalent to FONAFIFO or ICMBio with strong monitoring and enforcement mandates; financing constraints, as Angola does not yet possess dedicated PES funding mechanisms (e.g., earmarked taxes, water fees, or carbon markets); monitoring capacity, as geospatial and field-based MRV systems remain underdeveloped, limiting the feasibility of purist PES models; legal ambiguity, as although Angola has environmental legislation, none of its instruments explicitly regulate PES, unlike Costa Rica's Forestry Law or Brazil's National PES Law (Lei 14.119/2021); and community engagement challenges, as land tenure complexity and limited local governance structures hinder long-term contractual arrangements.

Despite these constraints, international experiences offer transferable lessons for Angola's oil sector: the importance of stable and predictable financing, the need for clear legal frameworks, the



centrality of robust MRV systems, and the value of community-based governance in areas with limited state presence. These insights support the argument that Angola should adopt a context-adapted, pragmatic PES model, integrating environmental objectives with social inclusion, community participation, and gradual institutional strengthening.

RELEVANCE FOR EXTRACTIVE INDUSTRIES

International organizations increasingly emphasize the importance of integrating Payments for Environmental Services (PES) into high-impact extractive sectors, where environmental degradation, carbon emissions, and biodiversity loss are most acute. The United Nations Environment Programme (UNEP), in its report "Payments for Ecosystem Services: Global Assessment and Recommendations" (UNEP, 2020), highlights that PES can complement regulatory instruments by creating incentive-based mechanisms for restoration, conservation, and community engagement in areas affected by mining and petroleum activities. The report stresses that extractive industries possess both the financial capacity and the environmental responsibility to support long-term ecosystem recovery.

Complementary perspectives are provided by the World Bank's "Environmental Compensation in Extractive Industries" (2019), which identifies PES as a strategic tool for internalizing environmental externalities in oil and mining operations, and by the FAO's "Ecosystem Services and Biodiversity in Africa" (2021), which underscores the relevance of PES for safeguarding watersheds, forests, and coastal ecosystems impacted by resource extraction. The Convention on Biological Diversity (CBD), through its Technical Series on Incentive Mechanisms, also recognizes PES as a viable instrument for aligning private-sector activities with biodiversity conservation targets.

These international assessments converge on several enabling conditions for effective PES implementation in extractive sectors: clear legal frameworks that define rights, responsibilities, and benefit-sharing mechanisms; robust MRV systems capable of tracking environmental performance and verifying compliance; institutional coordination among environmental agencies, concessionaires, and



local communities; stable financing models, including corporate contributions, environmental funds, or carbon markets; and transparent governance to prevent symbolic compliance or greenwashing.

In Angola, the relevance of PES for extractive industries is amplified by the oil sector's financial capacity, its extensive ecological footprint, and the growing pressure to adopt ESG-aligned practices. Petroleum operations intersect with sensitive ecosystems, such as mangrove forests, coastal wetlands, and marine habitats, where restoration and conservation efforts require long-term, predictable funding. PES offers a potential pathway to mobilize such resources while strengthening environmental governance and supporting national commitments to the SDGs, particularly SDGs 13, 14, and 15.

However, the applicability of international PES models to Angola must consider structural constraints, including legal ambiguity, limited monitoring capacity, and institutional fragmentation. These barriers indicate that Angola would benefit more from a pragmatic PES model, adapted to local governance realities, rather than attempting to replicate purist models from countries with stronger institutional frameworks.

PES AND THE OIL SECTOR IN ANGOLA

The oil industry is central to Angola's economy, accounting for 30-40% of national GDP, over 90% of export revenues, and more than 60% of fiscal revenues over the past decade, according to data from the National Agency for Petroleum, Gas and Biofuels (ANPG) and the Ministry of Finance. It is also one of the primary sources of environmental degradation in the country. Official reports from the Environmental Impact Assessment System (SIAIA) and the Ministry of Environment document recurrent impacts associated with petroleum extraction, including oil spills in offshore and coastal blocks, high levels of gas flaring in Soyo, contamination of soils and groundwater in onshore concessions, and pressures on ecologically sensitive areas such as mangrove forests and coastal wetlands. As of 2024, Angola has more than 30 active offshore and onshore concessions, with thousands of kilometers of



pipelines and associated infrastructure, underscoring the scale of environmental risk and the potential relevance of Payments for Environmental Services as a complementary governance instrument.

ENVIRONMENTAL IMPACTS

Key impacts include the following. Soil and water contamination: Documented spill events along the Namibe and Cabinda coastlines, reported by the Ministry of Environment and SIAIA, have resulted in hydrocarbon infiltration into coastal soils, groundwater, and nearshore marine ecosystems. Notable incidents include recurrent leaks in offshore Blocks 0 and 14, affecting artisanal fisheries and coastal communities. Atmospheric emissions from gas flaring: Angola remains one of the highest gas-flaring countries in Sub-Saharan Africa, with Soyo identified as a persistent hotspot due to limited gas-capture infrastructure. Satellite-based monitoring (NOAA/VIIIRS) shows consistently elevated flaring intensity in Blocks 2, 3, and 15, contributing to greenhouse gas emissions and local air-quality degradation. Habitat fragmentation and ecosystem pressure: Infrastructure associated with petroleum extraction, including access roads, pipelines, and support bases, has intensified pressure on ecologically sensitive areas. The Kissama National Park and its buffer zones have experienced habitat fragmentation linked to industrial expansion and increased human activity along the coastal corridor. Social impacts and community conflicts: In Cabinda, communities have reported displacement, restricted access to fishing grounds, and conflicts over compensation related to offshore and onshore operations. Studies by civil-society organizations and local authorities highlight tensions between oil operators and traditional fishing communities, particularly in areas adjacent to offshore platforms.

POTENTIAL APPLICATIONS OF PES

The potential applications of Payments for Environmental Services (PES) in Angola's oil sector require not only ecological justification but also economic feasibility, financing pathways, and clear cost-



benefit structures. The following applications integrate realistic cost estimates, funding mechanisms, and carbon-pricing opportunities relevant to Angola's institutional and environmental context.

Climate mitigation through reforestation and mangrove restoration: Large-scale mangrove restoration in Cabinda, Zaire, and Benguela typically costs USD 15,000-45,000 per hectare, depending on hydrological rehabilitation, removal of petroleum residues, and manual replanting. In severely degraded areas, costs may exceed USD 60,000/ha. Financing can come from ESG corporate funds, mandatory environmental compensation, blue-carbon markets (currently USD 18-35/tCO₂e), and partnerships with global restoration initiatives. Cost-benefit analyses show that restored mangroves can generate USD 8-12 in ecosystem services per dollar invested, including coastal protection, carbon sequestration, and fisheries productivity.

Water resource protection via watershed conservation: Watershed conservation in onshore petroleum regions (Bengo, Kwanza, Cabinda) requires USD 400-1,200 per hectare per year for reforestation, erosion control, and hydrological monitoring. Financing may be structured through industrial water tariffs, provincial environmental funds, corporate watershed PES, or water-use fees. International evidence shows that every dollar invested in watershed protection yields USD 3-6 in economic benefits, including reduced sedimentation, lower water-treatment costs, and improved water security for local communities.

Ecological restoration of degraded areas: Remediation of areas affected by oil spills, chronic contamination, or infrastructure development can cost USD 20,000-80,000 per hectare, depending on the need for bioremediation, soil replacement, and long-term monitoring. PES can operate as a co-financing mechanism, ensuring that companies internalize environmental externalities. Economic feasibility increases when linked to environmental liability insurance, remediation funds, and performance-based obligations embedded in concession agreements.

Community-based sustainable livelihoods: Community livelihood programs (sustainable fisheries, beekeeping, ecotourism, mangrove nurseries) require USD 250-900 per household per year. Funding can



come from corporate social responsibility budgets, community-level PES schemes, public-private partnerships, and international biodiversity funds (GEF, UNDP). African case studies show that each dollar invested in sustainable livelihoods generates USD 2-4 in local income, reducing conflicts and improving social acceptance of petroleum operations.

STRATEGIC ADVANTAGES FOR OIL COMPANIES

Adopting Payments for Environmental Services (PES) offers several strategic advantages for oil companies operating in Angola, particularly as the sector faces increasing scrutiny from investors, regulators, and international markets.

Strengthening ESG performance: PES provides measurable environmental outcomes (e.g., carbon sequestration, mangrove restoration, biodiversity protection) that can be incorporated into ESG reporting frameworks such as GRI, SASB, and TCFD. Companies with strong ESG metrics have been shown to access lower capital costs and improved investor confidence in emerging markets.

Reducing reputational and regulatory risks: Angola's environmental authorities (MinAmb, ANPG, IGEO) are progressively tightening compliance requirements. PES can serve as a risk-mitigation instrument, demonstrating proactive environmental stewardship and reducing exposure to fines, operational delays, and reputational crises linked to spills, flaring, or community conflicts.

Attracting international financing: Global climate funds (GEF, GCF), blue-carbon initiatives, and sustainability-linked loans increasingly require performance-based environmental indicators. PES projects, especially mangrove restoration and watershed protection, can generate certifiable carbon credits (USD 18-35/tCO₂e), improving access to concessional financing and blended-finance mechanisms.

Improving relations with local communities: PES can channel predictable financial flows to communities affected by petroleum operations, supporting livelihood diversification, co-management of natural resources, and conflict reduction. Evidence from Cabinda and Zaire shows that community-based environmental programs significantly improve social acceptance of extractive activities.



CHALLENGES

Despite its potential, implementing PES in Angola's oil sector faces several structural and institutional challenges.

Absence of specific PES legislation: Angola lacks a legal framework defining ecosystem services, payment mechanisms, contractual obligations, and benefit-sharing rules. Existing laws (Lei 5/98, Decreto 117/20, Lei 17/09) provide environmental principles but do not operationalize PES, creating uncertainty for companies and regulators.

Limited institutional capacity: Environmental agencies (MinAmb, SIAIA, provincial departments) face constraints in staffing, technical expertise, and budget, limiting their ability to design, monitor, and enforce PES schemes. This affects baseline assessments, verification, and long-term oversight.

Weak monitoring and MRV systems: Effective PES requires robust Monitoring, Reporting and Verification (MRV). Angola's current systems for tracking spills, flaring, biodiversity loss, and coastal degradation remain fragmented. Without reliable MRV, performance-based payments become difficult to justify.

Risks of symbolic or superficial initiatives: In contexts of weak enforcement, PES may be used as a CSR-style reputational tool rather than a mechanism delivering measurable environmental outcomes. This risk is heightened when companies self-report without independent verification.

Need for meaningful community participation: PES depends on clear land-use rights, community engagement, and benefit-sharing. In Angola, land tenure ambiguity and limited local governance structures can undermine participation, legitimacy, and long-term sustainability of PES contracts.

GOVERNANCE AND PUBLIC POLICIES

Effective PES implementation requires a coherent institutional and legal framework.



LEGAL AND INSTITUTIONAL GAPS

Although Angola does not yet have a dedicated law regulating Payments for Environmental Services (PES), the country possesses a substantial environmental legal framework that could serve as a foundation for the gradual institutionalization of PES mechanisms. The Environmental Framework Law (Lei No. 5/98) establishes the principles of environmental protection, sustainable development, and the polluter-pays principle, core elements that align conceptually with PES. Similarly, the Environmental Impact Assessment Decree (Decree 59/07, updated by Presidential Decree 117/20) mandates environmental licensing, mitigation, and monitoring for high-impact activities, offering potential entry points for PES-linked compensation or restoration obligations.

Additional sectoral legislation reinforces this foundation. The Fisheries and Aquaculture Law (Lei No. 9/04) regulates the sustainable use of marine and coastal resources, which could support PES schemes focused on mangrove restoration, coastal protection, and community-based fisheries management. The Coastal Zone Management Law (Lei No. 17/09) provides a legal basis for regulating activities in ecologically sensitive coastal and marine areas, many of which overlap with oil concessions, creating opportunities for PES to finance conservation and rehabilitation measures.

Angola's National Biodiversity Strategy and Action Plan (NBSAP) identifies ecosystem restoration, community participation, and sustainable use of natural resources as national priorities, all of which are compatible with PES instruments. Furthermore, Angola's Nationally Determined Contributions (NDCs) under the UNFCCC commit the country to reducing emissions from gas flaring, restoring degraded ecosystems, and enhancing climate resilience. PES could serve as a financing mechanism to operationalize these commitments, particularly in areas such as blue carbon, forest restoration, and coastal ecosystem protection.

Despite this legal architecture, significant institutional gaps hinder the implementation of PES. Environmental governance in Angola is characterized by fragmentation among the Ministry of Environment, the National Agency for Petroleum, Gas and Biofuels (ANPG), provincial governments,



and sectoral agencies. Overlapping mandates and inconsistent enforcement reduce regulatory effectiveness and create uncertainty for stakeholders. Moreover, monitoring, reporting, and verification (MRV) systems remain underdeveloped, limiting the ability to track environmental performance, verify conditionality, and ensure accountability, core requirements for any PES mechanism.

The absence of standardized guidelines for benefit-sharing, community participation, and environmental auditing further complicates implementation. Without clear rules defining who provides ecosystem services, who pays, how payments are distributed, and how outcomes are verified, PES risks becoming symbolic or vulnerable to greenwashing, particularly in a sector with strong economic and political influence such as oil and gas.

In this context, Angola's challenge is not the absence of environmental laws, but rather the lack of legal integration, institutional coordination, and operational mechanisms that would allow PES to function as a credible, performance-based instrument. Addressing these gaps requires: harmonizing existing environmental legislation to explicitly incorporate PES mechanisms; clarifying institutional roles and responsibilities across national and provincial levels; establishing standardized MRV protocols for restoration, carbon sequestration, and biodiversity outcomes; creating transparent benefit-sharing frameworks to ensure equity and community participation; and strengthening enforcement capacity through independent audits and public disclosure of environmental performance.

OPPORTUNITIES FOR INTEGRATION

PES offers multiple opportunities for integration into Angola's existing environmental and development policy frameworks. Rather than functioning as an isolated mechanism, PES can reinforce national strategies and international commitments.

National climate mitigation commitments: Angola's Nationally Determined Contributions (NDCs) under the UNFCCC prioritize reducing gas flaring, restoring degraded ecosystems, and enhancing carbon



sequestration. PES can provide performance-based financing for reforestation, mangrove restoration, and blue-carbon initiatives, directly supporting NDC implementation.

Water resource management strategies: PES can complement the National Water Plan, watershed protection programs, and provincial water-security strategies by financing erosion control, riparian restoration, and upstream conservation in petroleum-affected basins such as Bengo and Kwanza.

Biodiversity conservation policies: Angola's National Biodiversity Strategy and Action Plan (NBSAP) identifies ecosystem restoration, community participation, and sustainable use of natural resources as national priorities. PES can mobilize long-term funding for mangrove conservation, coastal ecosystem protection, and habitat restoration in areas affected by oil operations.

Community development programs: PES can strengthen community-based natural resource management, diversify livelihoods, and support local development plans, particularly in coastal communities affected by offshore petroleum activities. This aligns with Angola's decentralization agenda and provincial development strategies.

ALIGNMENT WITH SDGS

The alignment of PES with the Sustainable Development Goals (SDGs) must reflect the actual environmental and social outcomes associated with PES in Angola's oil sector. The most relevant SDGs are those directly linked to water, climate, marine ecosystems, and terrestrial biodiversity.

PES contributes directly to SDG 6 (Clean Water and Sanitation) through watershed protection, erosion control, and improved water quality in petroleum-affected basins; SDG 13 (Climate Action) via carbon sequestration from reforestation, mangrove restoration, and blue-carbon initiatives, supporting Angola's NDC commitments; SDG 14 (Life Below Water) by financing conservation of coastal wetlands, mangroves, estuaries, and marine habitats affected by offshore oil operations; and SDG 15 (Life on Land) through restoration of degraded terrestrial ecosystems, biodiversity conservation, and sustainable land management in onshore petroleum areas.



Indirect contributions may also occur for SDG 1 (No Poverty) and SDG 8 (Decent Work and Economic Growth) through community-based livelihood programs supported by PES, and SDG 12 (Responsible Consumption and Production) by incentivizing companies to internalize environmental externalities. This revised alignment reflects international best practices, Angola's national policy priorities, and the ecological realities of the oil sector.

ROLES OF KEY ACTORS

Effective implementation of Payments for Environmental Services (PES) in Angola requires the coordinated participation of a diverse set of stakeholders. Environmental governance in the country is inherently multi-actor, involving government institutions, private companies, civil society, research bodies, and international partners. Each group plays a distinct and complementary role in ensuring the legitimacy, transparency, and long-term sustainability of PES schemes.

Government institutions: National and provincial authorities (Ministry of Environment, ANPG, IGEO, municipal administrations) are responsible for establishing the legal framework, issuing regulations, overseeing environmental licensing, and ensuring transparency and enforcement. They also coordinate national strategies such as the NDCs and the National Biodiversity Strategy, which provide policy entry points for PES.

Oil companies: As major land-use actors and environmental risk generators, oil companies play a central role in financing PES schemes, implementing restoration and conservation activities, and aligning PES outcomes with corporate ESG commitments. They can also support MRV systems and community partnerships.

Local communities: Communities act as service providers, stewards of natural resources, and local monitors. Their participation is essential for legitimacy, benefit-sharing, and long-term sustainability. PES can strengthen community livelihoods and reduce conflict in petroleum-affected areas.



Environmental NGOs: Organizations such as WWF Angola, RARE, and local conservation groups contribute technical expertise, community engagement, biodiversity monitoring, and independent oversight. They often serve as intermediaries between companies, government, and communities.

International financial institutions: The World Bank, GEF, UNDP, and the Green Climate Fund provide funding, technical assistance, and performance-based financing for restoration, climate mitigation, and biodiversity conservation. These institutions can help scale PES initiatives and ensure compliance with global standards.

Licensed environmental consultancies: Accredited firms support environmental impact assessments, baseline studies, MRV design, and compliance audits. Their technical capacity is essential for ensuring that PES schemes are scientifically credible and verifiable.

Universities and research institutions: Academic institutions such as ISP, INIDE, and Angolan universities contribute ecological research, socio-economic assessments, and capacity building. They can also support long-term monitoring and evaluation of PES outcomes.

Scientific community and media: Researchers and journalists play a critical role in promoting transparency, disseminating information, and holding institutions accountable. Media coverage can increase public awareness and support for PES initiatives.

INSTITUTIONALIZATION PATHWAYS

The institutionalization of Payments for Environmental Services (PES) in Angola requires a phased and realistic approach aligned with the country's institutional capacity, legal architecture, and governance constraints. Instead of simultaneous reforms, a sequenced pathway increases feasibility and reduces implementation risks.

Phase 1: Foundational Measures (Short term: 1-2 years). Priority: Establish minimum governance conditions before legal reform. Develop standardized monitoring and MRV protocols: This is the most urgent step, as PES depends on verifiable environmental performance. MRV protocols for mangrove



restoration, watershed protection, and carbon sequestration should be led by the Ministry of Environment, with technical support from licensed consultancies, universities, and international partners (GEF, UNDP).

Rationale: Without MRV, PES cannot function as a performance-based mechanism. Launch national capacity-building programs: Training for provincial environmental departments, ANPG technicians, and community organizations is essential. Universities (ISP, INIDE) and NGOs (WWF Angola, RARE) can support curriculum development. Rationale: Institutional fragility makes capacity building a prerequisite for any legal or financial reform.

Phase 2: Legal and Policy Integration (Medium term: 2-4 years). Priority: Create legal clarity once technical and institutional foundations exist. Draft a National PES Framework Law: Led by the Ministry of Environment in coordination with the Ministry of Petroleum and Mineral Resources, this law should define ecosystem services, payment mechanisms, benefit-sharing rules, and contractual obligations.

Rationale: Legal reform must follow, not precede, the establishment of MRV and institutional capacity. Integrate PES into existing national strategies, including the NDCs, the National Biodiversity Strategy (NBSAP), and the National Water Plan. Rationale: Embedding PES in existing policies reduces political resistance and accelerates adoption.

Phase 3: Financial Mechanisms and Scaling (Long term: 4-7 years). Priority: Ensure long-term financial sustainability. Create a National PES Fund: Managed by the Ministry of Environment with multi-source financing: oil-sector contributions, climate funds (GEF, GCF), blue-carbon credits, and provincial environmental fees. Rationale: A fund should only be created once legal clarity and MRV systems are in place. Pilot PES schemes in priority ecosystems: Mangrove restoration in Cabinda and Zaire, watershed protection in Bengo and Kwanza, and biodiversity conservation in Kissama. Rationale: Pilots generate evidence, refine MRV, and build trust among stakeholders.



EVALUATION INDICATORS

PES effectiveness depends on indicators that are specific, measurable, verifiable, time-bound, and linked to clear responsibilities. The following indicators are adapted to Angola's institutional context and aligned with international MRV standards.

ENVIRONMENTAL INDICATORS

Hectares of restored ecosystems: Specific: Mangrove or forest areas restored in Cabinda, Zaire, Benguela. Unit: hectares (ha). Baseline: Established through satellite imagery (Sentinel-2 NDVI) and field inventories. Target: +50-200 ha restored per year depending on project scale. Verification: NDVI analysis, drone surveys, forest inventory plots. Frequency: Annual. Responsible: Ministry of Environment + licensed environmental consultancies.

Water quality improvement: Specific: Reduction in turbidity, BOD, COD, and hydrocarbon concentration in petroleum-affected basins. Unit: mg/L or NTU. Baseline: Laboratory analysis from provincial water authorities. Target: 10-30% improvement within 3 years. Verification: Certified laboratory tests. Frequency: Quarterly. Responsible: Provincial water departments + MinAmb.

CO₂ emissions reduced or sequestered: Specific: Carbon captured through reforestation and mangrove restoration. Unit: tCO₂e/year. Baseline: IPCC carbon-stock factors for Angola. Target: 5,000-20,000 tCO₂e/year depending on project size. Verification: Biomass sampling + IPCC Tier 2 calculations. Frequency: Annual. Responsible: MinAmb + ANPG + accredited MRV auditors.

Ecological integrity index: Specific: Composite index including species richness, canopy cover, soil stability. Unit: Index score (0-1). Baseline: Biodiversity surveys + remote sensing. Target: +0.1-0.2 improvement over 3-5 years. Verification: Field biodiversity assessments. Frequency: Biennial. Responsible: Universities + NGOs (WWF Angola, RARE).



SOCIAL INDICATORS

Number of beneficiary households: Unit: households. Baseline: Community census. Target: 200-1,000 households per PES project. Verification: Community registry + independent audits. Frequency: Annual. Responsible: Local administrations + NGOs.

Inclusion of vulnerable groups: Unit: % of women, youth, and low-income households participating. Baseline: Socioeconomic survey. Target: Greater than or equal to 40% participation of vulnerable groups. Verification: Household surveys. Frequency: Annual. Responsible: Social development offices + NGOs.

Training and capacity-building activities: Unit: number of participants trained. Baseline: 0 at project start. Target: 100-300 trained per year. Verification: Attendance records + evaluation forms. Frequency: Annual. Responsible: Universities (ISP, INIDE) + MinAmb.

Reduction in socio-environmental conflicts: Unit: number of reported conflicts/year. Baseline: Conflict registry from local authorities. Target: 20-50% reduction in 3 years. Verification: Administrative records + community surveys. Frequency: Annual. Responsible: Local governments + community councils.

ECONOMIC INDICATORS

Total investment in PES: Unit: USD/year. Baseline: Current corporate environmental spending. Target: USD 1-5 million/year depending on concession size. Verification: Financial reports + independent audits. Frequency: Annual. Responsible: Oil companies + ANPG.

Social and Environmental Return on Investment (SROI): Unit: USD returned per USD invested. Baseline: SROI = 0 at project start. Target: SROI of 2-6 within 5 years. Verification: SROI methodology (cost-benefit analysis). Frequency: Biennial. Responsible: Independent evaluators + MinAmb.



Reduction in mitigation and compensation costs: Unit: USD saved/year. Baseline: Historical environmental compliance costs. Target: 10-30% reduction over 5 years. Verification: Corporate financial statements. Frequency: Annual. Responsible: Oil companies + ANPG.

Local income generation: Unit: USD/year generated by community PES activities. Baseline: Household income survey. Target: +USD 200-600 per household/year. Verification: Household income surveys + project records. Frequency: Annual. Responsible: Local administrations + NGOs.

MONITORING METHODOLOGIES

Effective PES implementation requires a coherent, multi-layered MRV system that integrates remote sensing, field verification, laboratory analysis, community participation, and independent auditing. Rather than isolated methods, Angola needs an end-to-end MRV architecture that defines how data are collected, validated, reported, and used for performance-based payments.

Measurement (M): Data Collection Layer. This layer combines complementary data sources to ensure accuracy and reduce uncertainty. Satellite imagery and drones: Purpose: detect land-cover change, mangrove canopy recovery, erosion patterns. Tools: Sentinel-2 NDVI, Landsat 8, DJI drone photogrammetry. Frequency: Quarterly. Cost: USD 5-15/ha/year depending on resolution. Responsible: Ministry of Environment + licensed consultancies. Laboratory analyses: Purpose: water quality (BOD, COD, hydrocarbons), soil contamination, biomass carbon content. Frequency: Quarterly or semi-annual. Cost: USD 50-150 per sample. Responsible: Provincial environmental labs + accredited private labs. Community-based monitoring: Purpose: detect illegal logging, mangrove cutting, small spills, fishing pressure. Frequency: Continuous (weekly logs). Cost: USD 20-40/month per community monitor. Responsible: Community associations + NGOs (WWF Angola, RARE).

Reporting (R): Data Integration and Documentation Layer. This layer transforms raw data into standardized reports. Standardized reporting templates: Content: hectares restored, water quality trends, carbon sequestration, community participation. Frequency: Semi-annual and annual. Responsible: Oil



companies + MinAmb. Digital MRV platform: Purpose: centralize satellite data, lab results, community logs, and audit reports. Format: GIS-based dashboard accessible to MinAmb, ANPG, and provincial governments. Cost: USD 150,000-300,000 initial setup. Responsible: Ministry of Environment with donor support (GEF, UNDP).

Verification (V): Independent Validation Layer. This layer ensures credibility, transparency, and payment integrity. Independent audits: Purpose: verify restoration results, carbon calculations, community payments. Frequency: Annual. Cost: USD 30,000-80,000 per audit depending on project size. Responsible: Accredited third-party auditors (national or international). Scientific validation: Purpose: confirm ecological integrity, biodiversity recovery, carbon stock estimates. Frequency: Every 2-3 years. Responsible: Universities (ISP, INIDE) + research institutes.

The MRV system works as an integrated architecture: (1) Measurement: Satellite + drones detect changes, lab tests confirm water/soil quality, communities report local events. (2) Reporting: All data are uploaded to a digital MRV platform, standardized reports are generated, companies submit annual PES performance reports. (3) Verification: Independent auditors validate the reports, universities verify ecological metrics, MinAmb approves results, payments are released. (4) Feedback loop: Verified results update baselines, improve next cycle's targets, strengthen long-term PES performance.

DISCUSSION

CHALLENGES

The implementation of Payments for Environmental Services (PES) in Angola's oil sector faces several structural and governance-related challenges. These risks must be explicitly addressed to ensure that PES becomes a credible, performance-based mechanism rather than a symbolic environmental gesture.

Risk of corporate greenwashing: In line with the literature on corporate greenwashing (Laufer, 2003; Delmas & Burbano, 2011), oil companies may overstate environmental achievements or use PES as



a reputational tool without delivering measurable ecological outcomes. This risk is heightened in contexts of weak enforcement and limited public scrutiny. Safeguards include: mandatory third-party certification of PES results; public disclosure of MRV data through a national digital platform; independent ecological audits every 1-2 years; and alignment with international standards such as the Verified Carbon Standard (VCS) and Gold Standard.

Institutional fragility: Fragmented mandates between MinAmb, ANPG, provincial governments, and sectoral agencies reduce coordination and weaken enforcement. Mitigation strategies include: creation of an inter-ministerial PES coordination committee; standardized procedures for licensing, monitoring, and reporting; and capacity-building programs for provincial environmental departments.

Limited monitoring capacity: Weak MRV systems undermine the credibility of performance-based payments. Mitigation includes: adoption of an integrated MRV architecture (satellite + drones + labs + community monitoring + audits); partnerships with universities and licensed consultancies; and donor-funded technical assistance (GEF, UNDP, World Bank).

Inequitable distribution of benefits: Without clear benefit-sharing rules, PES may reinforce existing inequalities or exclude vulnerable groups. Mitigation includes: transparent benefit-sharing frameworks; minimum quotas for women, youth, and low-income households; and community-based monitoring committees.

Technical capacity gaps: PES requires ecological, hydrological, and carbon-accounting expertise that remains limited in Angola. Mitigation includes: long-term training programs led by universities (ISP, INIDE); partnerships with NGOs (WWF Angola, RARE); and integration of PES modules into environmental engineering and forestry curricula.



OPPORTUNITIES

PES offers opportunities to: strengthen ESG performance; access international financing; promote technological innovation; reduce conflicts with communities; and support national and global sustainability goals.

CRITICAL SYNTHESIS

A critical assessment of Payments for Environmental Services (PES) in Angola's oil sector must move beyond normative expectations and acknowledge the structural constraints that shape environmental governance in the country. While PES offers a theoretically promising mechanism for financing restoration, improving environmental performance, and strengthening community participation, its practical implementation is conditioned by institutional fragility, high dependence on petroleum revenues, limited monitoring capacity, weak enforcement, and systemic governance challenges.

Angola's political economy, characterized by centralized decision-making, limited transparency, and a historically constrained civil society, reduces the likelihood that PES will be implemented in a fully performance-based, accountable, and equitable manner in the near term. The risks of greenwashing, elite capture, and symbolic compliance are significant, particularly in a sector with strong reputational incentives and asymmetric power relations between companies, regulators, and communities.

For PES to move beyond aspirational discourse, deep institutional reforms are required, including: strengthening independent oversight bodies and third-party verification mechanisms; enhancing transparency and public disclosure of environmental performance; improving MRV capacity at national and provincial levels; ensuring meaningful community participation and equitable benefit-sharing; and integrating PES into broader governance reforms linked to decentralization, anti-corruption, and environmental accountability.

Given current conditions, the probability of fully effective PES implementation remains low in the short term. However, with coordinated international support, targeted capacity-building, and gradual



institutional strengthening, PES could evolve into a credible instrument for environmental governance and contribute to a more sustainable development trajectory in the medium to long term.

Thus, the transformative potential of PES in Angola does not lie in its conceptual design alone, but in the political will, institutional reforms, and external accountability mechanisms that determine whether it becomes a meaningful tool or remains a symbolic gesture.

IMPLICATIONS

The analysis of Payments for Environmental Services (PES) in Angola's oil sector reveals a set of implications that extend beyond environmental management and touch on broader questions of governance, political economy, and institutional reform. While PES is often presented as a transformative instrument capable of aligning economic incentives with ecological restoration, its real-world implications in Angola must be interpreted through the lens of institutional fragility, limited transparency, and high dependence on petroleum revenues.

First, the potential of PES to improve environmental outcomes is structurally constrained by weak monitoring systems, fragmented institutional mandates, and limited enforcement capacity. Without robust MRV systems, independent audits, and transparent reporting, PES risks becoming a symbolic mechanism rather than a performance-based tool. This reinforces the need for external accountability, including third-party certification, public disclosure of results, and scientific validation.

Second, the political economy of Angola, marked by centralized decision-making, asymmetric power relations, and historically limited civic oversight, means that PES may inadvertently reinforce existing inequalities unless accompanied by equitable benefit-sharing frameworks and strong community safeguards. The implications for social justice are therefore significant: PES can either empower communities or deepen exclusion, depending on governance arrangements.

Third, the country's dependence on oil revenues creates both opportunities and constraints. On one hand, the oil sector has the financial capacity to fund large-scale restoration and conservation initiatives.



On the other hand, the dominance of extractive interests may limit the political will to adopt reforms that impose stricter environmental obligations or independent oversight. This tension shapes the feasibility of PES as a credible governance instrument.

Fourth, the analysis suggests that international coordination will be essential for PES to function effectively. Institutions such as the World Bank, GEF, UNDP, and conservation NGOs can provide technical expertise, financial support, and independent verification, elements that are currently insufficient within national institutions. PES therefore has implications for Angola's engagement with global climate and biodiversity governance.

Finally, the broader implication is that PES should not be viewed as a standalone solution, but rather as a complementary instrument within a wider agenda of governance reform, decentralization, transparency, and environmental accountability. Without these systemic changes, the transformative potential of PES will remain limited, and the risk of greenwashing will persist.

In sum, the implications of adopting PES in Angola are ambivalent: the mechanism holds significant promise, but its success depends on political will, institutional strengthening, and sustained external oversight. PES can contribute to a more sustainable development trajectory, but only if embedded within deeper structural reforms that address the root causes of environmental degradation and governance weakness.

CONCLUSIONS

The analysis of Payments for Environmental Services (PES) in Angola's oil sector demonstrates that, while the mechanism holds conceptual promise, its practical feasibility is constrained by deep structural challenges. PES can contribute to improved environmental governance, community participation, and climate mitigation, but only under conditions that are not yet fully present in Angola's institutional landscape.



Angola faces significant barriers to effective PES implementation, including institutional fragility, limited monitoring capacity, weak enforcement, and systemic governance constraints. These challenges reduce the likelihood that PES will function as a fully performance-based, transparent, and equitable mechanism in the short term. The risk of greenwashing remains substantial without independent verification, public disclosure of results, and strong safeguards.

Comparatively, other African oil-producing countries such as Nigeria, Gabon, and Ghana have made more progress in environmental monitoring, biodiversity financing, or community-based natural resource management. Angola does not currently exhibit clear comparative advantages that would position it as a regional leader in sustainable environmental governance within the extractive industries. Any claim to such leadership would require demonstrable improvements in transparency, institutional capacity, and accountability mechanisms.

Nevertheless, PES could become a useful complementary instrument within a broader agenda of governance reform, decentralization, and environmental accountability. Its long-term potential depends on: strengthening MRV systems and independent audits; adopting clear legal frameworks and benefit-sharing rules; enhancing community participation; and securing coordinated international support for capacity building and verification.

In this sense, the transformative potential of PES in Angola is conditional on structural reforms, not guaranteed by the instrument itself. PES can contribute to a more sustainable development trajectory, but only if embedded within deeper institutional changes that address the root causes of environmental degradation and governance weakness.



DECLARATIONS

AUTHOR CONTRIBUTIONS

Conceptualization: M.C., G.J.; Methodology: M.C., G.J.; Investigation: M.C.; Writing - original draft: M.C.; Writing - review and editing: M.C., G.J., P.S. All authors have read and agreed to the published version of the manuscript.

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INSTITUTIONAL REVIEW BOARD STATEMENT

Not applicable.

INFORMED CONSENT STATEMENT

Not applicable.



DATA AVAILABILITY STATEMENT

This study is based exclusively on secondary data obtained from publicly accessible scientific literature, policy documents, environmental reports, and international databases. No primary data were collected.

All sources used in the analysis are cited in the References section and are publicly available.

CONFLICTS OF INTEREST

The authors declare no conflict of interest. The coauthors' academic roles did not influence the objectivity, analysis, or conclusions of this research. All procedures followed the ethical and editorial standards required for independent scientific work.

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