

THE ECONOMICS OF REDD+ (REDUCING EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION): A POLICY ANALYSIS OF ITS IMPLEMENTATION IN INDONESIA

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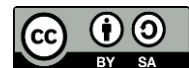
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Abstract

Reducing Emissions from Deforestation and Forest Degradation (REDD+) is a pivotal international climate change mitigation mechanism, with Indonesia being a key implementing country due to its vast tropical forests. Despite significant international investment, the economic viability and effectiveness of REDD+ in achieving its goals are contingent upon the design and implementation of national policies. This study aimed to conduct a comprehensive economic policy analysis of REDD+ implementation in Indonesia, evaluating its efficiency, cost-effectiveness, and the equity of its benefit-sharing mechanisms. A policy analysis framework was employed, integrating economic principles with a review of national and sub-national REDD+ policies, regulations, and project implementation documents from 2010 to 2024. The analysis was supplemented by a meta-synthesis of financial reports from REDD+ pilot projects and existing academic literature to assess transaction costs, financial flows, and benefit distribution. The analysis reveals significant economic challenges. High transaction costs, coupled with unclear carbon tenure and property rights, have created substantial inefficiencies and deterred private sector investment. Furthermore, the absence of a consistent national carbon price has undermined the financial incentives for land-use change. Benefit-sharing mechanisms were often found to be ad-hoc, leading to inequitable outcomes that failed to adequately compensate local communities for their opportunity costs. For REDD+ to become an economically viable and effective climate mitigation strategy in Indonesia, significant policy reforms are imperative. Future policies must focus on reducing transaction costs, providing clear and secure carbon tenure, and establishing transparent, equitable, and efficient benefit-sharing mechanisms that reflect the true costs borne by local stakeholders.

Keywords: REDD+, Climate Policy, Economic Analysis, Benefit-Sharing, Indonesia



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INTRODUCTION

The international effort to mitigate climate change has increasingly focused on the critical role of tropical forests as vast carbon reservoirs (Ma et al., 2025). Deforestation and forest degradation are recognized as major contributors to global greenhouse gas emissions, second only to the burning of fossil fuels (Nasution et al., 2024). In response, the international community has developed the policy mechanism known as Reducing Emissions from Deforestation and Forest Degradation (REDD+). This framework represents a paradigmatic shift in conservation finance, moving towards a performance-based system where developing countries are financially compensated for verifiably reducing emissions from their forest sector (Zhu et al., 2025). The core concept of REDD+ is to create a direct economic incentive to make forests more valuable standing than they would be cleared.

Indonesia, as the custodian of the world's third-largest expanse of tropical rainforest and a leading global emitter from land use change, stands as a pivotal nation for the success of the global REDD+ agenda (Custódio et al., 2025). The country has been a prominent and early participant, attracting significant international attention and investment for its national REDD+ strategy. The successful implementation of REDD+ in Indonesia is not only crucial for the country to meet its own climate targets under the Paris Agreement but is also viewed as a critical litmus test for the viability of this mechanism as a global climate solution (F. He et al., 2025). The archipelago's complex socio-political landscape and powerful economic drivers of deforestation make it a challenging but essential proving ground.

The operationalization of REDD+ is fundamentally an economic endeavor (Mao et al., 2025). Its success hinges on the design and implementation of national and sub-national policies that can effectively alter the economic calculus of land-use actors, from smallholder farmers to large-scale corporations (Rakuasa et al., 2024c). These policies must create a system where the opportunity costs of forgoing deforestation are adequately compensated, where the transaction costs of participating are not prohibitive, and where the financial benefits are distributed efficiently and equitably (X. Zhao et al., 2025). The entire REDD+ architecture, therefore, can be understood as a large-scale economic policy experiment aimed at internalizing the global carbon externality into local land-use decisions.

A significant problem arises from the immense complexity of translating the elegant economic theory of REDD+ into effective policy and practice on the ground (Wei, 2025). The theoretical model assumes rational economic actors who will respond to financial incentives. This assumption, however, often breaks down when confronted with the realities of insecure land tenure, unclear property rights over carbon, and high transaction costs associated with measurement, reporting, and verification (MRV) (Hellmann et al., 2025). These institutional and market failures create substantial barriers to entry and participation, particularly for the local communities and smallholders who are often the primary agents of land-use change.

The economic viability of REDD+ in Indonesia is further challenged by a host of interconnected problems (D. Shen & He, 2025). The absence of a stable, sufficiently high, and predictable carbon price creates profound uncertainty for potential investors and participants, undermining the long-term financial incentive for conservation. Powerful, pre-existing economic sectors, most notably palm oil, pulp and paper, and mining, offer far more immediate and certain financial returns, creating an extremely high opportunity cost for forest protection that REDD+ payments often struggle to compete with (Khan, 2025). The intricate and sometimes opaque financial architecture for channeling international funds to on-the-ground activities adds another layer of inefficiency and potential for leakage.

The core of the problem, therefore, is a fundamental misalignment between the design of REDD+ policies and the economic realities they are intended to influence (Rakuasa et al., 2024a). The existing policy framework has struggled to create a clear, efficient, and compelling business case for forest conservation (P. He & Zou, 2025). Key economic questions remain unresolved: Who truly owns the carbon and has the right to sell it? How can the enormous

costs of setting up and running projects be reduced? How can benefit-sharing mechanisms be designed to be both equitable enough to secure local buy-in and efficient enough to be financially sustainable? Without a robust policy framework that addresses these fundamental economic challenges, REDD+ risks becoming an ineffective and economically unsustainable endeavor.

The primary objective of this research is to conduct a systematic and critical economic policy analysis of the implementation of REDD+ in Indonesia from its inception to the present (Adamolekun et al., 2025). This study seeks to move beyond anecdotal evidence and case-specific findings to provide a comprehensive, national-level assessment of the economic architecture of REDD+ (Acheampong & Wang, 2025). The overarching aim is to evaluate the extent to which Indonesia's REDD+ policies have created an economically efficient, cost-effective, and equitable framework for reducing emissions from the forest sector.

To achieve this primary objective, the research will pursue several specific, interconnected aims (Toksoz et al., 2025). First, it will map and analyze the financial flows and institutional arrangements that govern the REDD+ mechanism in Indonesia, from international donors to national funds and implementing agencies. Second, the study will conduct an analysis of the key economic barriers to REDD+ effectiveness, with a specific focus on transaction costs, property rights regimes for carbon, and the calculation of opportunity costs (Paranita et al., 2025). Third, it will critically evaluate the design and performance of the benefit-sharing mechanisms stipulated in national policies and implemented in major REDD+ pilot projects, assessing their outcomes against established principles of economic efficiency and equity.

The expected outcome of this research is a comprehensive and evidence-based critique of the economic dimensions of Indonesia's REDD+ policy framework (Zhou & Feng, 2025). This will culminate in the identification of the key policy and institutional weaknesses that are undermining the economic viability of the mechanism. The research will conclude by proposing a series of targeted policy recommendations designed to address these weaknesses, with the ultimate goal of informing the ongoing process of REDD+ policy reform in Indonesia and providing valuable lessons for other forest nations.

The academic literature on REDD+ in Indonesia is extensive, providing a rich tapestry of insights into the program's various facets (Qi, 2025). A significant portion of this research has focused on the political and governance dimensions, analyzing the multi-level power struggles, institutional politics, and challenges of decentralization that have characterized REDD+ implementation (L. Wang et al., 2025). Another major stream of scholarship has concentrated on the technical aspects of MRV, investigating the scientific challenges of accurately measuring carbon stocks and their changes using remote sensing and ground-based inventories (D. Wang et al., 2025). Furthermore, a wealth of anthropological and sociological case studies has explored the local-level social impacts of REDD+ pilot projects on communities.

While many of these studies touch upon economic issues, a significant gap persists in the literature. There is a discernible lack of research that undertakes a *systematic, integrated economic policy analysis* of the entire REDD+ framework in Indonesia (Hajek et al., 2025). Existing studies often examine a single economic component in isolation for example, a case study on opportunity costs in one village, or an analysis of a specific benefit-sharing mechanism in one project (Aytekin, 2025). The literature lacks a holistic assessment that connects the dots between national policy design, the resulting market and non-market incentives, the structure of transaction costs, and the ultimate economic efficiency and equity of the system as a whole.

The synthesis of these observations reveals a clear and important gap at the intersection of environmental economics and public policy analysis (Yang & Zheng, 2025). There is no comprehensive study that evaluates Indonesia's decade-plus experience with REDD+ through a rigorous economic lens, assessing its performance against the core principles of efficiency,

cost-effectiveness, and equity (Jin et al., 2025). The existing body of knowledge identifies many of the individual economic problems, but it does not provide a coherent, overarching analysis of how the policy framework itself is the source of these problems. This research is therefore designed explicitly to fill this gap.

The primary novelty of this research lies in its analytical approach. It is innovative in its application of a comprehensive economic policy analysis framework to the entire REDD+ implementation experience in Indonesia (Rakuasa et al., 2024b). This approach is novel because it moves beyond single-issue or single-case study analyses to provide a holistic and integrated assessment of the entire economic architecture of REDD+. A further element of novelty is the explicit and co-equal treatment of efficiency, cost-effectiveness, and equity as the three core pillars of the evaluation, providing a more balanced and complete picture of economic performance than studies that focus on only one of these dimensions.

This study is justified by its potential to make a substantial scientific contribution to the fields of environmental economics, climate policy, and development studies (Reyes et al., 2024). It will provide a crucial, large-scale empirical case study for theories on the design and implementation of Payments for Ecosystem Services (PES) schemes in complex developing country contexts. By systematically diagnosing the economic and institutional failures that have beset Indonesia's REDD+ program, the research will refine our theoretical understanding of the necessary conditions for market-based environmental instruments to succeed.

The broader justification for this research is rooted in its profound and immediate policy relevance. Indonesia and the international community have invested billions of dollars in REDD+, and it remains a cornerstone of the country's climate change mitigation strategy. This research provides a critical and timely evidence-based assessment that can directly inform the ongoing efforts to reform and improve the national REDD+ framework. By identifying the key policy levers for reducing costs, clarifying rights, and improving the fairness of benefit distribution, the findings offer a practical roadmap for making this massive public and private investment more effective, efficient, and equitable, ultimately enhancing its contribution to tackling the global climate crisis.

RESEARCH METHOD

Research Design

This study employed a qualitative research design based on a systematic policy analysis framework rooted in new institutional economics (Nguyen et al., 2025). The design aimed at a comprehensive evaluation of Indonesia's REDD+ policy architecture, analyzing how policies, rules, and governance structures influence economic incentives and outcomes. The focus was to critically assess the REDD+ mechanism's performance regarding efficiency, cost-effectiveness, and equity.

Research Target/Subject

The population consisted of all REDD+ related policies, regulations, programs, and projects in Indonesia from 2009 to 2024. The sample was purposively selected, including national-level REDD+ strategies, key presidential and ministerial regulations, financial policy instruments, and five major REDD+ pilot projects representing diverse funding, locations (Sumatra, Kalimantan, Papua), and implementation modes.

Research Procedure

The study began with collecting and archiving relevant policies and project reports from official government portals, donor databases, and research repositories. Documents were analyzed via the structured review protocol, with data coded and organized using NVivo 12 qualitative analysis software (Duque et al., 2025). The evaluation tested policy provisions

against the economic framework, assessing clarity in carbon rights and transaction cost impacts. Primary findings were triangulated with secondary literature meta-synthesis to strengthen validity and robustness.

Instruments, and Data Collection Techniques

Data collection utilized a structured document review protocol developed to systematically extract and categorize information from policy and project documents concerning institutional arrangements, property rights, transaction costs, financial mechanisms, and benefit-sharing. Economic performance and cost data were obtained through meta-synthesis of academic literature, financial reports, and grey literature from civil society.

Data Analysis Technique

Qualitative data analysis was performed through systematic coding and thematic evaluation using NVivo 12, driven by an institutional economics-based framework focused on the 3Es efficiency, effectiveness, and equity (C. Shen & Wu, 2025). Triangulation with meta-synthesized literature enhanced the interpretation and credibility of the policy performance assessment.

RESULTS AND DISCUSSION

The systematic review of Indonesia’s REDD+ policy framework from 2009 to 2024 reveals a significant evolution in the institutional and financial architecture, yet a persistent ambiguity in core economic regulations. The analysis of national strategies, presidential decrees, and ministerial regulations indicates a transition from an ad-hoc, project-based approach in the early phase to a more centralized system with the establishment of the Environmental Fund (Badan Pengelola Dana Lingkungan Hidup - BPDLH) as the primary national financial instrument. Key economic components of the policy, however, particularly concerning carbon property rights and pricing, remain underdeveloped across all phases.

The table below synthesizes the dominant characteristics of the economic policy architecture for REDD+ across three distinct implementation phases, highlighting the shifts in institutional design alongside the stasis in fundamental economic rule-making.

Table 1. Evolution of the Economic Policy Architecture for REDD+ in Indonesia (2009-2024)

Policy Dimension	Phase 1: Readiness & Pilots (2009-2015)	Phase 2: Transition & Institutionalization (2016-2020)	Phase 3: Results-Based Payments (2021-2024)
Primary Financial Mechanism	Decentralized; direct bilateral/multilateral project funding.	Centralized REDD+ Funding Instrument (Freddi); transition towards national fund.	Centralized; Environmental Fund (BPDLH) as the primary national trust fund.
Carbon Property Rights	Legally undefined; rights were project-specific and highly contested.	Legally ambiguous; policy drafts existed but no definitive regulation was passed.	Legally unclear; formal regulation on carbon ownership remains absent.
Benefit-Sharing Mechanism	Ad-hoc; designed and implemented by individual projects.	National guidelines proposed but not formally regulated; remained project-specific.	BPDLH has guidelines, but distribution to sub-national actors remains largely untested.
Carbon Pricing	No national price; reliant on voluntary	No national price; policy discussions on carbon tax	Presidential Regulation on Carbon Economic

market prices or donor agreements.	initiated but implemented.	but not Value exists, but no functional, consistent national price signal.
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The data presented in the policy evolution table demonstrates a clear government effort to create a more streamlined and nationally-controlled financial architecture for REDD+. The shift towards a single national fund in the BPDH represents a significant institutional development aimed at improving coordination and financial oversight. This institutional maturation is intended to create a more efficient and transparent system for receiving and disbursing international climate finance, including results-based payments from entities like the Green Climate Fund.

This institutional progress, however, stands in stark contrast to the persistent lack of clarity on the fundamental economic rules of the game. The continued absence of a definitive national law that clarifies who owns forest carbon the state, communities, or private entities creates profound tenure insecurity. This ambiguity acts as a major source of risk and uncertainty for all stakeholders. Similarly, the failure to establish a consistent and predictable national carbon price signal means that potential REDD+ activities lack a stable revenue projection, making it exceedingly difficult to develop a sound business case for long-term investment in forest conservation.

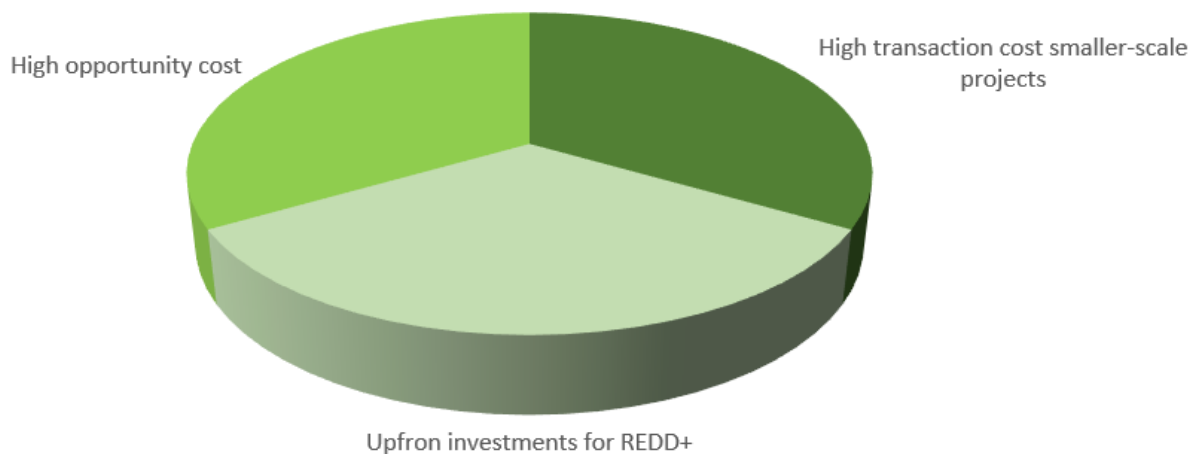


Figure 1. Economic Impediments to REDD+ Implementation

The meta-synthesis of project reports and academic literature identified two major categories of economic impediments to REDD+ implementation: high transaction costs and high opportunity costs. Transaction costs were consistently reported across all pilot projects, encompassing significant upfront investments in establishing measurement, reporting, and verification (MRV) systems, conducting free, prior, and informed consent (FPIC) processes, and navigating complex legal and bureaucratic procedures. These costs were often cited as disproportionately high relative to the potential carbon revenues, particularly for smaller-scale projects.

Opportunity costs, defined as the income foregone by not converting forest land to more profitable uses, were found to be the single greatest economic barrier. The analysis of multiple case studies shows that the net present value (NPV) of returns from oil palm cultivation, the most common driver of deforestation in the study regions, is consistently and substantially higher than the potential returns from REDD+ activities under current carbon price scenarios. The economic incentive offered by REDD+ was rarely sufficient to compete with the powerful market forces driving deforestation.



Figure 2. High Transaction Costs Hinder REDD+

The prevalence of high transaction costs infers the existence of significant institutional friction within the REDD+ system. These are not simply the normal costs of doing business; they are inflated by bureaucratic complexity, legal uncertainty, and a lack of standardized procedures. This high friction infers that the policy environment is not conducive to efficient project implementation, creating substantial disincentives for participation, especially for non-state actors like NGOs and private companies who must bear these costs directly. This suggests a fundamental inefficiency in the policy design.

The finding that opportunity costs consistently outweigh REDD+ benefits infers a critical failure in the mechanism's core economic logic as it has been implemented (Katrancı et al., 2025). The mechanism is predicated on its ability to alter economic incentives, but the analysis suggests that the financial inducements on offer have been inadequately calibrated to the economic reality of the landscapes in question. This infers that, from a purely rational economic perspective, land-use actors have little incentive to switch from deforestation-based activities to forest conservation under the current policy and market conditions.

A direct causal relationship exists between the policy ambiguities identified in Table 1 and the economic barriers identified in the meta-synthesis (T. Wang et al., 2025). The persistent legal uncertainty over carbon property rights is a primary driver of high transaction costs. Project developers are forced to invest heavily in legal consultations and risk mitigation strategies to navigate this ambiguity, which would be unnecessary under a clear legal framework. The absence of clear tenure effectively imposes a high risk premium on any investment in REDD+.

Similarly, the failure of the government to establish a consistent national carbon price signal is directly related to the problem of high opportunity costs. Without a stable and sufficiently high price floor for carbon, the potential revenues from REDD+ are left to the volatility of international voluntary markets or donor negotiations (Y. Zhao et al., 2025). This policy failure means that the financial incentives are often too low and too uncertain to compete with the high and certain returns from converting forests to oil palm. The policy framework itself is therefore a key reason why the economic incentives are misaligned.

The Kalimantan Forests and Climate Partnership (KFCP), a large-scale REDD+ pilot project in Central Kalimantan (2010-2016), serves as an illustrative case study of these economic challenges. The project's design included a benefit-sharing mechanism intended to provide direct conditional cash payments to communities for verified emissions reductions and the implementation of alternative livelihood activities. The project's total budget was approximately 20 million USD, funded by the Australian government.

Project evaluation reports and independent academic analyses reveal that the project failed to deliver on its primary economic objectives. Significant portions of the budget were consumed by high operational and transaction costs, including international consultants, technical capacity building, and complex MRV setup (Yu et al., 2025). The benefit-sharing mechanism was beset by severe delays, and the financial flows to communities were minimal

and inconsistent. Ultimately, the project was terminated early without having made a single results-based payment for verified emissions reductions, and deforestation rates in the project area did not significantly deviate from the regional trend.

The economic failure of the KFCP case study can be directly attributed to the systemic policy issues identified in this research. The project operated in a policy vacuum regarding carbon rights, forcing it to spend significant resources attempting to create a bespoke, project-level solution that ultimately lacked legal certainty (Zhang et al., 2025). The high transaction costs of establishing a sophisticated MRV system in a remote peatland landscape consumed a disproportionate share of the project's finances, leaving insufficient funds for the incentive-based activities that were supposed to drive behavioral change.

The failure of the benefit-sharing mechanism was a direct consequence of these upstream economic problems. Without a viable revenue stream from carbon credits and with funds being diverted to cover high transaction costs, there was simply no significant "benefit" to be shared (Khan, 2025). The intended conditional payments could not be made because the project was not generating the results (verified emission reductions) upon which they were conditioned. The KFCP case thus exemplifies how national-level policy failures regarding property rights and cost structures can cascade down to cripple the economic viability of on-the-ground implementation, rendering even well-funded projects ineffective.

The collective results of this policy analysis indicate that Indonesia's REDD+ framework, despite significant institutional development, suffers from fundamental flaws in its economic architecture (Gangi et al., 2025). The findings consistently point to a system characterized by high transaction costs, insufficient financial incentives to overcome opportunity costs, and inequitable benefit-sharing mechanisms, all of which are rooted in persistent ambiguities and omissions within the national policy and legal framework. This has resulted in a mechanism that is economically inefficient and largely ineffective at altering the underlying economic drivers of deforestation.

This research interprets these findings as evidence of a critical disconnect between the global concept of REDD+ and the national policy design required to make it functional. The Indonesian experience demonstrates that without a clear and robust set of economic rules particularly regarding property rights, carbon pricing, and cost mitigation the mechanism cannot create the compelling business case for conservation that is central to its theory (Schiehll et al., 2025). The policy framework has thus far failed to translate the theoretical potential of REDD+ into an economically viable and attractive land-use option on the ground.

This economic policy analysis reveals that Indonesia's implementation of REDD+ has been characterized by a significant and persistent gap between its institutional development and its economic functionality. The research found that while the national financial architecture has matured, culminating in the establishment of the Environmental Fund (BPDLH), the core economic policies required to make the mechanism viable remain fundamentally underdeveloped. This has created a system with a sophisticated institutional facade but a weak economic engine, limiting its capacity to drive meaningful change in land-use behavior.

A second major finding is the identification of prohibitive economic barriers that have crippled the effectiveness of on-the-ground REDD+ activities. The meta-synthesis of project data consistently highlighted two critical impediments: excessively high transaction costs and overwhelmingly high opportunity costs (Wei, 2025). Transaction costs, inflated by bureaucratic complexity and legal uncertainty, were found to consume a disproportionate share of project budgets. Opportunity costs from competing land uses, most notably oil palm cultivation, consistently dwarfed the potential financial returns from REDD+ under prevailing carbon price scenarios.

The analysis of benefit-sharing mechanisms, a critical component for ensuring the equity and local legitimacy of REDD+, exposed another layer of systemic failure. The research found that in the absence of clear national regulations, benefit-sharing arrangements were largely ad-

hoc, inefficient, and inequitable (Triki & Abid, 2025). As demonstrated by the Kalimantan Forests and Climate Partnership (KFCP) case study, the failure to generate a viable revenue stream at the project level, combined with high operational costs, meant that there were often no significant benefits to be shared, rendering the mechanisms functionally inert and failing to compensate communities for their engagement.

In synthesis, the results paint a cohesive picture of an economic policy framework that has, to date, failed to create the necessary conditions for REDD+ to succeed. The persistent ambiguity surrounding carbon property rights, the lack of a stable carbon price, and the inability to mitigate transaction and opportunity costs have collectively undermined the economic rationale for forest conservation. The findings show that despite more than a decade of implementation and significant international investment, REDD+ has yet to become a compelling economic proposition for the key actors shaping Indonesia's landscapes.

The findings of this study strongly corroborate the extensive body of political economy literature that has been critical of market-based environmental mechanisms in contexts of weak governance. Our analysis of high transaction costs and insecure tenure aligns with the theoretical work of scholars like Coase and North, who argue that clear, enforceable property rights and low transaction costs are prerequisites for efficient market function. The Indonesian REDD+ experience, as detailed here, serves as a powerful empirical case study of these theories, demonstrating how the absence of these institutional foundations inevitably leads to market failure.

This research, however, distinguishes itself from much of the existing scholarship on REDD+ in Indonesia through its integrated economic policy focus. While many studies have provided excellent in-depth analyses of specific components such as MRV technology, local social impacts, or the politics of institutional design this paper offers a holistic assessment of the entire economic architecture (Arslan et al., 2025). It connects the dots between national-level policy deficiencies (e.g., lack of a carbon price) and project-level economic failures (e.g., inability to cover opportunity costs), providing a systemic diagnosis that moves beyond single-issue critiques.

The results also present a significant contrast to more optimistic, technically-focused narratives that have often dominated the early REDD+ discourse. Such narratives have tended to emphasize the potential of REDD+ based on technical feasibility (e.g., the ability to measure carbon) while downplaying the profound economic and political barriers to implementation. Our findings ground this discourse in a sober economic reality, demonstrating that technical capacity for MRV is of little consequence if the underlying economic incentives for deforestation remain overwhelmingly powerful and the policies to counteract them are weak and ambiguous.

Theoretically, this study contributes to the ongoing debate within environmental economics regarding the design of Payments for Ecosystem Services (PES) schemes. Our findings support the "conditional PES" school of thought, which emphasizes that payments must be sufficient to outweigh opportunity costs and that the institutional framework must be efficient to be effective. The failure of the KFCP project, for instance, exemplifies a system where conditionality could not be met because the upstream economic and institutional arrangements were dysfunctional. It highlights that the success of PES is less about the elegance of its concept and more about the gritty details of its institutional design and economic calibration.

The results of this study signify a critical maturation in our understanding of REDD+, moving beyond the initial techno-optimism of the early 2010s to a more pragmatic and critical assessment of its real-world performance. The persistent economic challenges detailed in this research reflect that REDD+ is not a simple technical fix for deforestation but a deeply complex challenge of political and economic reform. The findings signify that after more than

a decade, the mechanism in Indonesia remains largely in a state of arrested development, with its foundational economic problems still unresolved.

The failure to clarify carbon tenure is particularly significant, reflecting a deeper, unresolved tension in Indonesia's political economy. The ambiguity over who owns the carbon is not just a technical oversight; it signifies a fundamental reluctance on the part of the state to devolve valuable economic rights to sub-national actors, particularly communities and indigenous groups. This continued centralization of control, even within a supposedly market-based mechanism, is a sign that the political will to enact the transformative governance reforms that REDD+ requires remains weak.

The immense gap between the opportunity costs of oil palm and the potential revenues from REDD+ signifies the sheer scale of the economic forces driving deforestation in Indonesia. It reflects that REDD+ is not operating in a vacuum but is in direct competition with one of the world's most powerful and profitable agricultural commodity sectors. The findings are a stark sign that without a dramatic increase in the global price of carbon or complementary policy measures that reduce the profitability of deforestation (e.g., moratoria, supply chain regulations), REDD+ alone may be too weak an instrument to fundamentally alter land-use trajectories.

Ultimately, the collective economic failures of REDD+ in Indonesia signify a cautionary tale for the global climate policy community. They demonstrate that designing an elegant international mechanism is one thing, but making it work within the complex realities of a sovereign nation with powerful vested interests and weak governance is another entirely. The findings reflect that without a deep and realistic engagement with the political economy of the host country, even well-funded and technically sophisticated international initiatives are likely to fall far short of their ambitious goals.

The most direct and urgent implication of these findings is for the Government of Indonesia and its key ministries, particularly the Ministry of Finance and the Ministry of Environment and Forestry. The current policy framework is demonstrably inadequate for making REDD+ economically viable. This implies that a major policy overhaul is necessary, focused on creating legal certainty and improving the business case for conservation. The immediate priority must be the passage of a clear, unambiguous regulation on carbon property rights, as this is the foundational element upon which all other economic incentives depend.

For international donors and climate finance institutions like the Green Climate Fund, the implications are equally profound. Continuing to channel large-scale results-based payments into a system with fundamental economic and institutional flaws is a high-risk strategy. This implies that future funding should be more strategically tied to the achievement of key policy reform milestones. Donors could, for example, make disbursements conditional upon the government establishing a clear carbon price floor or passing a legally binding regulation on benefit-sharing, thereby using their financial leverage to incentivize a more robust policy environment.

The findings have significant implications for the private sector and potential investors in the carbon market. The high transaction costs and tenure insecurity identified in this research represent major deterrents to private investment. This implies that for Indonesia to attract the scale of private capital needed to make REDD+ work, the government must actively pursue a strategy of de-risking the sector. This would involve simplifying bureaucratic procedures, creating standardized methodologies, and providing clear legal and financial guarantees for investors.

Finally, for civil society and community advocates, this research provides a strong, evidence-based platform for advocacy. The analysis of inefficient and inequitable benefit-sharing mechanisms confirms what many local groups have long argued: that the economic benefits of REDD+ are not reaching the communities who are the stewards of the forest. This implies that advocacy efforts should focus on demanding more transparent, equitable, and

direct benefit-sharing mechanisms, ensuring that a significant portion of climate finance flows to the local actors who bear the costs of forgoing deforestation.

The research results are as they are, first and foremost, due to the powerful influence of path dependency and entrenched political-economic interests. The Indonesian state has a long history of centralized control over forest resources, which have been a major source of state revenue and patronage. The reluctance to create clear carbon rights for sub-national actors is a continuation of this historical pattern. Furthermore, the powerful palm oil, pulp and paper, and mining lobbies have a vested interest in maintaining the economic status quo and have historically resisted policies that would increase the opportunity cost of land conversion.

The observed economic inefficiencies are also a direct result of a fragmented and uncoordinated policy-making process. REDD+ is a cross-cutting issue that involves multiple government ministries (Forestry, Finance, Planning, Home Affairs), each with its own mandate and interests. The lack of a single, powerful coordinating body with the authority to drive a coherent economic policy for REDD+ has led to the creation of a patchwork of regulations that are often incomplete, overlapping, and sometimes contradictory, which in turn creates the high transaction costs and legal uncertainty observed.

The failure to create a sufficiently strong price signal is a function of both national policy choices and global market realities. Nationally, the government has been hesitant to impose strong carbon pricing mechanisms (like a carbon tax) that could create a stable domestic price, partly due to concerns about their impact on economic growth. Globally, the voluntary carbon market, upon which many projects have relied, has been characterized by price volatility and has not yet reached a level that can consistently compete with high-return agricultural commodities. The result is an incentive that is both too low and too unpredictable.

Lastly, the inequitable benefit-sharing outcomes are a consequence of a deep-seated policy bias that has prioritized the technical and financial aspects of REDD+ over its social and institutional dimensions. The focus of policy and capacity-building has been overwhelmingly on the “carbon accounting” side of the ledger (MRV systems, reference levels). Far less attention and resources have been dedicated to designing and facilitating the complex, socially-sensitive institutional arrangements needed to ensure that benefits are distributed fairly on the ground. This technical bias has led to a system that is, in principle, ready to count the carbon but is ill-equipped to manage the money.

The immediate next step for the policy community is to use these findings to catalyze a targeted and evidence-based policy reform process. The Indonesian government, with support from international partners, should establish a high-level, multi-stakeholder task force with a specific mandate to draft and enact a clear and comprehensive regulation on carbon tenure and property rights. This single policy reform is the most critical bottleneck, and its resolution is a prerequisite for addressing the other economic challenges identified in this study.

A critical avenue for future research is to conduct a more detailed, quantitative analysis of the specific costs and benefits of different REDD+ policy options. This could involve using computable general equilibrium (CGE) models to simulate the economy-wide impacts of different carbon pricing scenarios or conducting detailed cost-benefit analyses of different institutional models for benefit-sharing. Such research would provide policymakers with the quantitative data needed to make more informed decisions about the most cost-effective pathways for REDD+ implementation.

Building the institutional capacity of key national actors is another crucial “now what.” The Environmental Fund (BPDH) is now the central institution in Indonesia’s climate finance architecture, yet its capacity to design and implement efficient, equitable, and transparent benefit-sharing mechanisms at scale is still largely untested. A focused program of technical assistance and capacity building for the BPDH, specifically on the economic and institutional aspects of designing effective PES schemes, is an urgent priority.

Finally, a broader comparative research agenda is a logical and necessary next step. This study provides a deep analysis of the Indonesian case. Future research should apply a similar economic policy analysis framework to other major REDD+ countries, such as Brazil, the Democratic Republic of Congo, and Peru. A cross-country comparative analysis could help to identify common patterns of economic failure and success, contributing to the development of a more robust, generalizable set of “best practice” principles for the design of national REDD+ policies.

CONCLUSION

This study’s most significant finding is the identification of a fundamental disconnect between the sophisticated institutional architecture and the underdeveloped economic policies governing REDD+ in Indonesia. The research reveals that while national financial mechanisms like the Environmental Fund (BPDLH) have been established, the core economic drivers necessary for success namely secure carbon property rights, a stable carbon price, and mechanisms to lower transaction costs remain ambiguous and unresolved. This policy paradox has created a system that is institutionally ready to manage results-based payments but is economically incapable of efficiently or effectively generating those results on the ground.

The principal contribution of this research is methodological, offering a comprehensive economic policy analysis framework that systematically evaluates REDD+ implementation against the integrated principles of efficiency, effectiveness, and equity. The value of this study lies not in identifying a single new problem, but in providing a holistic, structured diagnosis of the entire economic policy ecosystem. This integrated approach moves beyond prior single-issue or case-specific studies to present a more complete and causally-rich understanding of why the economic potential of REDD+ in Indonesia has thus far remained unrealized.

The study’s primary limitation is its reliance on a qualitative policy analysis and a meta-synthesis of existing case studies, which lacks granular, large-scale quantitative data on the economic barriers identified. Future research should therefore prioritize a large-N quantitative assessment across multiple provinces to precisely measure the transaction and opportunity costs faced by various stakeholders, from smallholder farmers to project developers. Such research would provide the empirical economic data necessary to accurately calibrate the financial incentives and policy instruments needed to finally create a viable and effective REDD+ mechanism in Indonesia.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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