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From Reactive Fire Suppression to Risk-Adjusted Prevention: Financing Fire-Free Land Preparation in Indonesia's Peatland Landscapes

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A R T I C L E I N F O

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A B S T R A C T

Indonesia's recurring forest and land fires expose a persistent public-finance paradox: fire-free land preparation can impose substantial upfront costs on liquidity-constrained farmers, while fire response and subsequent losses are dispersed across governments, communities and ecosystems. This qualitative literature review critically synthesises peer-reviewed research published from 2020 through 2026 to assess whether targeted support for pembukaan lahan tanpa bakar (PLTB) can form a defensible prevention-financing instrument. Drawing on externality theory, expected-loss appraisal and social–ecological governance, it distinguishes private preparation costs, contingent suppression expenditure and wider social damages. A thematic synthesis identifies seven interdependent findings: financing constraints, hydrological and climatic risk, conditional policy effectiveness, incompatible costing denominators, extensive external damages, spatial treatment heterogeneity and governance requirements. An illustrative break-even frontier demonstrates why gross per-hectare comparisons cannot prove fiscal savings without additional, causally attributable fire prevention. The review proposes a risk-adjusted financing framework combining shared equipment, technical extension, conditional incentives, peatland rewetting, legitimate enforcement and counterfactual monitoring

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INTRODUCTION

1. Recurrent Landscape Fires as an Economic and Governance Problem

Forest and land fires in Indonesia are neither exclusively natural disasters nor merely the cumulative consequence of individual land-clearing choices. They emerge from interaction among weather, land-cover change, drained peat soils, tenure arrangements, infrastructure, production systems and political incentives. A fire ignited on one parcel can propagate through neighbouring vegetation or peat and generate losses far beyond the decision-maker's property boundary. The resulting externalities affect crops, forests, human health, transportation, biodiversity and carbon storage, making the geographic and institutional scale of harm fundamentally different from the scale at which ignition decisions are made. Research on Indonesia's fire causation and Kalimantan land-use patterns consistently indicates that climate and land-management effects must be assessed together rather than treated as competing explanations (Edwards et al., 2020; Santika et al., 2020; Schmidt et al., 2024). This mismatch has a recognisable fiscal dimension. Public agencies undertake preparedness, detection, ground suppression, logistical mobilisation, aviation and post-fire recovery, whereas much of the cost reduction motivating inexpensive land clearing accrues privately. Moreover, the severe consequences of escaped fires are contingent rather than certain. A smallholder choosing preparation technology observes immediate cash needs and labour obligations, not the full expected value of downstream damages. The economic issue is therefore one of incentive compatibility, constrained liquidity and risk pooling as much as a conventional prohibition on burning. Literature on the health impacts and cost of Indonesian fires demonstrates that socially relevant losses can greatly exceed immediate operational expenditure, though they depend on how exposed populations and carbon damages are valued (Kiely et al., 2021; Hein et al., 2022; Phung et al., 2022).

2. The Initial Literature Review and Limits of its Cost Comparison

The September 2026 practitioner note as background (Risdiyanto, 2026) compares burning-related land-preparation expenditures reportedly around IDR 0.4–0.6 million per hectare with reported costs of IDR 3–10 million per hectare for no-burn preparation, known in Indonesia as pembukaan lahan tanpa bakar (PLTB). It also recounts major 2026 fire-response deployments and proposes an analytical range of IDR 50–200 million per burned hectare under intensive integrated suppression. These are contextual figures in the source note, not harmonised primary research observations: the note explicitly labels the response-cost range an analytical estimate and provides no integrated dataset through which site conditions, time horizons and cost denominators can be standardised. Accordingly, the figures are used below exclusively to motivate bounded scenarios and are not introduced as independently verified regional averages. At first sight, an apparent contrast between a few million rupiah for PLTB and tens or hundreds of millions for response might suggest that prevention finance is always cheaper. That inference requires further analytical elaboration. A hectare prepared without burning does not necessarily correspond to a hectare that would otherwise experience uncontrolled fire; nor is a quoted helicopter operating rate equivalent to all government fire expenditures

per unit area. Prepared area, burned area, treated landscape, aircraft flight hours and fire incidents have distinct denominators. The appropriate fiscal test asks how much *additional* consequential fire probability or severity is avoided by a particular policy relative to a credible counterfactual, and what portion of suppression spending can actually be reduced rather than merely reassigned (Baylis and Boomhower, 2023; Jalilov et al., 2025; Castro et al., 2026).

3. Research Significance and Contribution

The literature offers substantial knowledge about peatland degradation, fire occurrence, restoration, no-burn policies, community institutions and environmental damages. Yet these strands are commonly discussed in isolation. Ecological models estimate how changing land cover or peat moisture may reduce fire occurrence, whereas governance studies evaluate enforcement, incentives or participatory restoration. Economic assessments value damages or restoration benefits but rarely provide a directly implementable financing rule connecting farmer-level incremental costs to marginal, attributable public risk reduction. This gap motivates an integrative conceptual article rather than another isolated inventory of physical restoration technologies or a universal claim about spending efficiency (Carmenta et al., 2021; Horton et al., 2022; Puspitaloka et al., 2021; Yuwati et al., 2026). The review addresses seven linked questions: why private and social calculations diverge; which risk determinants matter; how comparable cost units should be constructed; when an incentive can pass a public-budget test; how to target assistance equitably; how PLTB can complement restoration and enforcement; and how the policy should be evaluated. Its contribution is a distinction between fiscal savings, net social benefit and distributional legitimacy within a single prevention-finance architecture. It does not presume that any specific subsidy level, technological package or fire-reduction estimate has been empirically established for all provinces. Instead, it proposes a transparent, falsifiable basis on which district-level programmes could be piloted, evaluated and, if successful, scaled (Ward et al., 2020; Fischer et al., 2021; Robins et al., 2022).

LITERATURE RIVIEW

1. Externalities, Opportunity Costs and the Incidence of Wildfire Expenditure

An externality occurs when the consequences of an action are borne by parties who are not fully reflected in the actor's decision. In the PLTB context, a landholder facing high cash and equipment costs may rationally choose a cheaper method even when accidental spread exposes neighbouring households and public budgets to serious risk. This discrepancy should not be confused with ignorance or an inherently negligent preference. The household may understand the danger and still confront binding liquidity, credit, technical or seasonal constraints. A policy instrument designed to internalise external costs needs to reduce the marginal price of safe behaviour, raise the expected consequence of hazardous behaviour, or both. Evidence on villagers' responses to Indonesia's no-burn rules indicates that enforcement interacts with livelihoods, legitimacy and available alternatives, rather than operating as a costless substitute for them

(Resosudarmo et al., 2023; Ekawati et al., 2024). Public suppression expenditure may itself affect behaviour. When emergency costs are socialised across taxpayers and not paid by beneficiaries or risk creators, the allocation of land management and development decisions can be distorted. Evidence from the United States demonstrates that geographically differentiated wildfire suppression subsidies can be material, although its institutional setting differs from Indonesian smallholder peatlands. This comparison offers a public-finance concept, not a transferable coefficient: one must identify the beneficiary, risk-generating action and counterfactual public burden before inferring subsidy incidence. A prevention scheme that merely moves funds from an emergency line to a farmer payment without preventing events would not improve efficiency, while one that averts high-consequence ignitions could reduce both fiscal exposure and social welfare losses (Baylis and Boomhower, 2023; Kiely et al., 2021).

2. Expected Loss, Probability and the Social Discounting Problem

Prevention should be evaluated ex ante using an expected-loss model rather than comparing the highest observed disaster bill with a routine preparation invoice. For any intervention, the baseline risk of a consequential fire, the treated risk, the conditional cost of the event and the time horizon must be defined on compatible spatial and temporal units. A programme may reduce ignition probability, limit area burned, lower intensity, or alter exposure, and these pathways have different implications for budget savings. Analysts should not assume that observed post-intervention reductions in fire activity are caused by the intervention: rainfall, the El Niño–Southern Oscillation, land conversion or enforcement can change simultaneously. Heterogeneous evidence from Kalimantan shows why baseline environmental conditions and landscape properties are central to prediction and causal inference (Santika et al., 2020; Imron et al., 2022; Fauziah et al., 2025). A second question concerns time. No-burn preparation is often paid for immediately, while prevented damage is an uncertain benefit realised during later seasons or extreme drought years. Recurring equipment maintenance, machinery depreciation, extension services and verification need to be compared with discounted expected benefits over a stated analysis period. In a public-budget calculation, conditional suppression costs must be net of expenditure that remains fixed even when fewer fires occur; standby readiness cannot automatically be treated as fully avoidable. In a social cost-benefit calculation, real labour and machinery resources are counted, while grants to farmers generally represent transfers between social groups and are not simply added as extra resource costs. Restoration economics has emphasised the need to document forgone land uses and trade-offs, which become especially salient when peat protection alters agricultural options (Jalilov et al., 2025; Januar et al., 2023; Yunus et al., 2024).

3. Social–Ecological Systems and Legitimacy

Landscape fire is a collective-action problem because ignition and propagation are influenced by activities across parcel boundaries, shared drainage networks and governance jurisdictions. Institutional arrangements

determine whether equipment can be shared, whether villagers trust eligibility rules, who maintains water-control structures and whose observations are accepted by authorities. Social–ecological research suggests that interventions achieve durable change when rules and incentives are compatible with community livelihoods and institutions. A programme that pays isolated farmers without attention to neighbours, concession roads or canal water levels may show compliance at individual plots while leaving landscape risk nearly unchanged (Harrison et al., 2020; Robins et al., 2022; Toumbourou et al., 2024). Regulatory authority is necessary, but a narrow policing model has shortcomings. Research on Indonesia's plantations documents contestation over hydro-governance and unequal capacities to influence rules, while field-level work on rural burning prohibitions shows that perceived legitimacy and availability of alternatives influence compliance. Bureaucratic fragmentation can weaken inter-agency preparation, data sharing and expenditure allocation even where the environmental objective is widely endorsed. Incentive finance should therefore be embedded in accountable intergovernmental institutions rather than treated as a standalone farm voucher capable of overriding tenure conflict, delayed payments or contested rule enforcement (Astuti, 2021; Purnomo et al., 2021; Resosudarmo et al., 2023).

4. Peat Hydrology, Landscape Context and Climatic Hazard

Intact peatland systems depend on saturated conditions that constrain oxidation and deep combustion. Drainage, degradation and repeated burning can transform these landscapes into highly vulnerable fire environments, particularly during prolonged dry conditions. Maps of Indonesia's peat extent and depth show major geographic variation, making a uniform incentive per hectare an imprecise tool for managing risk. Spatial fire analyses additionally identify interactions among village livelihood patterns, industrial plantations, peatland degradation and climate variation. Preparation technology may address one ignition mechanism but does not independently reverse the fire sensitivity created by hydrological degradation (Anda et al., 2021; Santika et al., 2020; Sinclair et al., 2020). Rewetting provides a complementary intervention that changes the physical probability of peat combustion and the potential scale of damages. Studies of rewetting and subsidence indicate material biophysical benefits from raising groundwater levels, while modelling assessments suggest that carefully selected restoration sites can produce substantial reductions in fire occurrence. Such numbers are not mechanically additive: a scheme combining rewetting and PLTB could have overlapping prevention effects, and its total benefit must be estimated jointly. Counterfactual evidence from 2026 also reports substantial differences in canal-block performance, underscoring the importance of hydrogeological siting and real-world implementation rather than nominal numbers of completed structures (Hooijer et al., 2024; Horton et al., 2022; Castro et al., 2026).

5. Incentive Additionality, Distribution and the Limits of Rewards

Incentives for environmental stewardship face an additionality problem: funds may be paid to actors who would already have used non-burning methods, while high-risk households can remain excluded because they lack formal documents or the ability to prefinance compliance. Universal hectare payments may also create pressure for expansion or misreported preparation area. Cost-sharing schemes must distinguish legitimate operating land from newly converted forest, and the verification of safe preparation cannot rely exclusively on the absence of detected hotspots. Qualitative comparative analysis of Indonesian fire-prevention initiatives suggests that bundles involving governance, sanctions and awareness may matter more than undifferentiated rewards; its results caution against assuming that a transfer alone reliably changes behaviour (Carmenta et al., 2021; Wulandari et al., 2025). Distributional equity is not incidental to economic efficiency. Farmers with narrow operating margins may face proportionally larger transaction costs than well-capitalised estates, while Indigenous and local communities can hold different relational and use values for peat landscapes. Co-designed projects must account for differing tenure regimes, women and marginalised households, village decision structures and the availability of culturally appropriate production methods. Agroforestry and low-drainage crops may create income pathways that are more compatible with peat conservation, but their commercial viability and agronomic requirements vary by site. These findings support assistance tied to independently assessed constraints and landscape risk, rather than entitlement based solely on the number of hectares claimed (Abdurrahim et al., 2023; Uda et al., 2020; Applegate et al., 2022; Yunus et al., 2025). Figure 1 integrates the preceding conceptual mechanisms into an explicitly conditional chain from farmer constraints and landscape conditions to fire and fiscal outcomes. It also marks the main causal interruption: financing PLTB is an observable programme input, whereas avoided fires are a counterfactual outcome that requires separate evidence. This distinction is central to the article's proposed financial appraisal (Alexandra et al., 2026; Carmenta et al., 2021).



Figure 1. Causal Architecture of Risk-Adjusted PLTB Prevention Finance (Conceptual, Not an Estimated Causal Effect)

The figure depicts risk conditions and land-management institutions as modifiers of the relationship between incentives and ignition or spread. Its separate outcome boxes prevent the common error of treating private adoption, government budget savings and external social benefits as interchangeable. A coherent appraisal would measure each transition with an appropriate indicator rather than infer all final outcomes from a simple count of subsidised hectares (Horton et al., 2022; Hein et al., 2022).

6. Environmental Damages as Distinct Policy-Accounting Components

Fire damage is multidimensional. Direct losses of agricultural production and forest capital are only part of the relevant social burden; smoke emissions produce morbidity and mortality, while peat combustion contributes carbon emissions and long-term degradation. The literature provides strong evidence that the total value of these effects can be very large, but estimates are sensitive to model assumptions, emission factors, baseline mortality, geographic exposure and valuation approaches. An economic appraisal must therefore state whether it measures cash expenditures, economic losses, public-health benefits, welfare values, or avoided greenhouse gas emissions. Combining incompatible estimates without adjusting scope, period or overlapping endpoints risks inflating projected returns (Kiely et al., 2020; Kiely et al., 2021; Hein et al., 2022; Phung et al., 2022). Atmospheric research adds further nuance because haze composition, transport and exposure can change by location and burning conditions. Estimates of emissions require transparent activity data, fuel mass and combustion assumptions; a fire prevented on one parcel need not yield an average national emission factor. Climate benefits of avoiding degradation and rewetting require consideration of greenhouse gas pathways, methane dynamics and alternative land use. Scientific analyses of Indonesian emissions, Southeast Asian peat-swamp carbon and rewetting demonstrate the considerable mitigation potential, while wider peat research warns that impacts depend on ecosystem condition. This strengthens the case for integrated policy but does not justify attaching the same uniform health or carbon price to every hectare of PLTB (Kuwata et al., 2024; Krisnawati et al., 2023; Sasmito et al., 2025; Günther et al., 2020; Wilkinson et al., 2023).

METHODOLOGY

1. Qualitative Literature Review Design

This article applies a critical qualitative literature review (QLR), not a systematic literature review or meta-analysis. The objective is conceptual integration and contextual interpretation of heterogeneous empirical, modelling and policy studies. The review uses purposive thematic selection rather than claiming exhaustive database coverage, prespecified PRISMA screening, pooled intervention effects or a numerical risk-of-bias score. Peer-reviewed journal work published from 2020 to October 2026 is prioritised because the paper addresses contemporary fire-prevention policy, restoration technologies and public-finance design. The September 2026 practitioner note (Risdiyanto, 2026) functions only as a motivating source, not peer-reviewed empirical evidence. Its 2026 incident,

procurement and aviation figures remain unverified within this review and must not be read as an official fiscal series. The analytical approach combines three perspectives. Public economics provides the distinction between transfers, incremental real costs and contingent avoided losses. Social–ecological systems thinking explains why governance, hydrology and landholder behaviour interact. A critical evidence lens separates observational associations, experimental or quasi-experimental findings, modelled counterfactuals and normative policy propositions. This design is appropriate when relevant scholarship spans hydrology, economics, anthropology, public health, earth observation and institutional research, with incompatible outcome variables and identification strategies. It permits robust conceptual comparison without inventing a pooled average or claiming quantitative precision unsupported by the underlying evidence (Fischer et al., 2021; Indrajaya et al., 2022; Jalilov et al., 2025).

2. Search and Evidence Appraisal

The literature corpus was assembled by targeted searching of article titles, DOI landing pages and journal repositories for combinations of peatland fire, Indonesia, fire-free land preparation, no-burning policy, smallholders, restoration, fire suppression, livelihoods, governance, economic valuation and smoke health effects. Reference chaining from recent interdisciplinary reviews expanded the theoretical and empirical coverage. Papers were prioritised for relevance to specific analytical mechanisms, methodological transparency and contemporary publication. Supplementary studies outside Indonesia were retained only where they illuminated transferable concepts, such as suppression subsidy incidence and peat-carbon dynamics; their contextual differences are explicitly acknowledged. Fifty-two DOI-linked articles form the retained manuscript bibliography, with each cited in the discussion or synthesis. A complementary methodological principle is to separate prediction-oriented mapping from intervention-effect identification. In a phased pilot, recent econometric work advises estimating cohort- and time-specific effects and checking sensitivity to differential trends, heterogeneous treatment effects and treatment timing rather than assuming conventional two-way fixed effects remain unbiased (Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Roth et al., 2023). Evidence was grouped according to what it can legitimately establish. Spatial associations help locate risk but usually do not isolate treatment effects. Process evaluations illuminate feasibility but may not quantify prevented fires. Counterfactual evaluations permit more credible effect estimates under assumptions, while scenario modelling is useful for exploring plausible mechanisms without constituting observed programme outcomes. Health and carbon valuation studies establish broader consequences but may not measure costs borne by specific districts. This hierarchical interpretation follows the caution evident in studies of no-burning enforcement, community participation, long-term restoration assessment and regional fire modelling (Resosudarmo et al., 2023; Purnomo et al., 2024; Hooijer et al., 2024; Zahro et al., 2025).

3. Abductive Coding and Illustrative Calculations

Thematic synthesis was conducted across seven recurrent categories: farm-level adoption constraints; baseline environmental vulnerability; combinations of policy instruments; incompatible monetary accounts; social externalities; targeting heterogeneity; and the governance and evaluation conditions of successful implementation. Themes were derived by moving iteratively between economic theory, the motivating practitioner note and empirical research. Divergent findings were not averaged away. For example, studies showing conditional impacts of incentive bundles, rewetting or restoration were preserved as context-specific rather than harmonised into a universal prevention effect. This work constitutes a literature-based interpretive synthesis, not an original survey, budget audit or measured programme evaluation (Carmenta et al., 2021; Tan et al., 2022; Castro et al., 2026). Illustrative arithmetic is used solely to clarify the unit-consistency and threshold logic. Parameters such as a hypothetical IDR 5 million public support package, conditional suppression costs of IDR 50–200 million and probability reductions ranging from 1 to 15 percentage points are scenario assumptions, not coefficients estimated by this review. The scenarios make transparent how a plausible public-finance conclusion changes when fire risk, additionality, suppression cost avoidability or implementation expenses change. Sensitivity is shown explicitly and conclusions are phrased conditionally. No empirically identified Indonesian PLTB benefit–cost ratio is claimed; that would require local treatment data, verified expenditure records and a credible untreated counterfactual.

RESULT

1. Theme One: Private Affordability is a Key Bottleneck

Across studies, the feasibility of fire-free production is shaped by household liquidity, labour demand, access to machinery, agronomic advice and alternative land-use options. It is unsurprising that policies framed only as a ban may reduce one visible burning practice without creating a viable replacement technique. Field research on community-level effects of zero-burning policy documents livelihood changes, local resistance and the limited suitability of some promoted alternatives. Community-focused participatory action research similarly identifies demand, political support, social capital and sustainable business models as conditions for meaningful behavioural change. These findings suggest that the binding barrier is not always the price level alone; it may be the timing of the payment, ability to access rented equipment or perceived agronomic risk (Ekawati et al., 2024; Purnomo et al., 2024; Applegate et al., 2022).

The practitioner note suggests that private cost differences provide a useful point of departure but cannot be used as a nationally representative subsidy schedule. The same nominal hectare may contain standing woody biomass, old crop residues, shallow peat or mineral soil, each requiring different equipment, repeat operations and disposal methods. A farmer may also incur opportunity costs when delaying cultivation or switching crops. An effective programme would therefore assess incremental costs for a specific technically

verified preparation method and local land condition. Shared-machine provision and contractor procurement may lower fixed costs more efficiently than a cash grant, while credit or reimbursement timing may address liquidity more directly. Evidence on paludiculture and alternative peatland livelihoods reinforces the need to evaluate subsequent farm returns as well as immediate clearing expenditure (Uda et al., 2020; Yunus et al., 2025; Puspitaloka et al., 2021).

2. Theme Two: Vulnerability is Concentrated and Time-Dependent

Fire risk is spatially uneven. Degraded peatland, drainage networks, land-cover types, road access and industrial land uses interact with climatic drought. Consequently, an additional rupiah spent in a high-risk hydrological unit may reduce expected losses more than the same rupiah distributed proportionately across all eligible agricultural parcels. Remote sensing, fire history and hydrological indicators are valuable for allocating inspection capacity, although historical hotspots are imperfect proxies for individual responsibility. Recent modelling in Kalimantan and Bengkalis demonstrates the value of environmental covariates for identifying vulnerability, while empirical studies of protected landscapes show that human disturbances can change the protection afforded by formal boundaries (Santika et al., 2020; Horton et al., 2022; Imron et al., 2022; Fauziah et al., 2025). Recent machine-learning evidence from Central Kalimantan finds that distances to canals and settlements are important predictors of fire occurrence when combined with drought, land cover and peat-depth variables (Horton et al., 2021). These predictive relationships can improve the prioritisation of field inspections and hydrological management, but they must not be interpreted as causal evidence that subsidising a particular landholder will avert a specified number of incidents. This theme produces two distinct targeting rules. First, programme priority should increase with the expected marginal benefit of reduced ignition or spread, rather than simply with the landholder's claimed preparation costs. Second, it should reflect the ability of the intervention to change behaviour under local conditions. A highly fire-prone area whose fires originate primarily from landscape drainage, rather than farm ignition, may need water management before or alongside PLTB. Conversely, a farm cluster with repeated preventable escaped ignitions may benefit strongly from coordinated mechanical preparation, residue management and monitoring. Fire-frequency histories over extended periods support risk stratification, yet uncertain weather and shifting land use require continual model recalibration (Schmidt et al., 2024; Sinclair et al., 2020; Zahro et al., 2025).

3. Theme Three: Interventions Work as Bundles, Not Standalone Payments

Evidence does not support the assumption that offering a cash reward is sufficient to prevent peat fires. Comparative analysis of interventions found that combinations of enforcement, awareness and contextual conditions were influential, while simple rewards were not consistently associated with successful outcomes. Interviews with villagers and officials show that enforcement may generate compliance but also has adverse consequences where alternatives are unaffordable, enforcement is selective or legitimacy is weak. This variation makes it essential to distinguish the incentive *instrument* from the full

prevention *package*: access to machines, advice, group coordination, early detection, credible sanctions and transparent land-use obligations may be mutually reinforcing (Carmenta et al., 2021; Resosudarmo et al., 2023; Purnomo et al., 2021). Evidence from participatory restoration projects and knowledge-system approaches further indicates that the social process through which programmes are designed is part of implementation effectiveness. Village leadership, farmer organisations and local environmental observers can improve monitoring and reduce information asymmetry, but they can also reproduce unequal power if eligibility decisions are opaque. Social networks matter for post-fire land management and sustained cooperation, while large-scale plantation governance has different bargaining asymmetries. These observations favour collectively negotiated but independently auditable contracts with grievance channels, disclosed selection criteria and documented safeguards rather than purely discretionary village-level payments (Purnomo et al., 2024; Robins et al., 2022; Wulandari et al., 2025; Astuti, 2021).

4. Theme four: cost accounts are often incomparable

Four different monetary objects recur in fire-policy discussions: the private resource cost of preparing land; the fiscal expenditure of government response; the wider real economic losses caused by fire; and transfers between taxpayers and beneficiaries. These objects differ in payer, time horizon, occurrence probability and unit. A quoted per-hectare PLTB cost is generally incurred on an actual area prepared. A cost per burned hectare divides selected emergency expenditure by an area that has already experienced fire and depends heavily on incident severity and what agencies include in accounting. The two should not be directly subtracted as if they were marginal alternatives for the same hectare. Similarly, a helicopter charge per flight hour cannot be converted into a standard response charge without a measured incident, flight allocation and burned area (Kiely et al., 2021; Baylis and Boomhower, 2023; Jalilov et al., 2025). A valid appraisal requires the distinction between avoided and merely reallocated expenditure. Salaries of permanent firefighters, investment in existing equipment and readiness activities may remain necessary even if a programme prevents several fires. Fuel, contracted aircraft hours, temporary logistics and overtime might be more responsive, but actual contracts and budgeting rules determine whether cash outlays are avoidable within a fiscal year. Ecological damages may be material while not appearing in district emergency accounts. Furthermore, the cost of restoring peatland is not interchangeable with the incremental cost of no-burn farm preparation, although both can contribute to prevention. Economic reviews consistently argue for explicit treatment of spatial scope, counterfactual land use, transaction costs and the burden of restoration on affected groups (Januar et al., 2023; Jalilov et al., 2025; Yunus et al., 2024). Table 1 makes the accounting problem operational by classifying common costs according to payer, conditionality and unit. The table should be read as a taxonomy for designing a district-level data collection system, not as a cost dataset. It highlights why fiscal, private and social expenditures

require different counterfactual assumptions (Kiely et al., 2021; Jalilov et al., 2025).

Table 1. Accounting Taxonomy for Comparable Fire-Prevention Appraisals

Cost category	Immediate payer	Timing / decision unit	Interpretation
Fire-based preparation	Farmer / contractor	Actual prepared area; upfront	Private baseline method cost, not avoided fire loss
Fire-free preparation (PLTB)	Farmer / programme	Actual prepared area; upfront	Gross resource requirements; incremental difference matters
Incentive or voucher	Public budget → participant	Verified activity and fiscal period	Fiscal outlay and transfer; avoid social double counting
Suppression / aviation	Government agencies	Actual incident, flight hours, affected area	Only variable attributable share can be avoided
Health and lost livelihoods	Households, employers, public services	Exposure period, affected population	Social losses, not necessarily government cash savings
Peatland carbon and ecosystems	Society, future generations	Area and event-specific horizon	Separate valuation and overlapping-benefit safeguards

The table also clarifies that a subsidy is a transfer for aggregate social accounting but a cash outlay in the government budget. Similarly, a helicopter hour is a unit of procurement, not a transferable rate per hectare of fire avoided. Interpreting these distinctions correctly is a necessary precursor to any benefit-cost ratio (Baylis and Boomhower, 2023).

5. Theme Five: The Wider Social Benefits of Prevention Can Be Substantial

Empirical modelling has assigned large economic consequences to Indonesian fires, with damages extending beyond immediate suppression. For example, one major Nature Communications analysis estimated US$28 billion in losses from the 2015 Indonesian fires and evaluated the possible benefits of prior peatland restoration. This estimate is conditional on its modelled scope and valuation assumptions, not a cash statement of government firefighting costs. Health studies additionally attribute extensive mortality, respiratory illness and lost workdays to peatland-fire particulate exposure, revealing harms largely omitted from narrow budget comparisons. A policy justified only by expected fiscal savings may therefore understate its potential social value, even while it remains necessary to demonstrate that a specific intervention changes the relevant risk (Kiely et al., 2021; Hein et al., 2022; Kiely et al., 2020). The evidentiary implication is caution against double counting. A health valuation may already capitalise lost productivity that appears elsewhere in economic damage estimates. Carbon values may reflect national or international social accounting rather than a cash payment received by local agencies. Restoration also provides benefits not limited to avoided fire, including reduced subsidence, ecological recovery and potentially hydrological services, but these outputs cannot be

assigned wholly to PLTB. More recent regional carbon estimates highlight large mitigation opportunities from peat-swamp conservation and restoration, while atmospheric analyses underline emission uncertainties and the need for calibrated exposures. Separate, clearly delimited fiscal, social and climate accounts are more defensible than a single sensational benefit-cost ratio (Sasmito et al., 2025; Kuwata et al., 2024; Hooijer et al., 2024; Krisnawati et al., 2023). Weather modification is occasionally included within integrated responses and risk mitigation, but it has operational and meteorological constraints. Indonesian studies demonstrate the engineering attention given to rainfall-enhancement interventions and possible carbon-emissions reduction, yet these are not evidence that weather modification can substitute for year-round land preparation, peat hydrology or ignition prevention (Sandhyavitri et al., 2023a; Sandhyavitri et al., 2023b). Their costs, conditions and impacts should remain distinct in fiscal comparisons.

6. Theme Six: Local Performance Heterogeneity Matters for Public Value

Risk maps are not sufficient if the treatment fails to prevent ignition or spread. Simulation-based work suggests strong potential from targeted land management in Central Kalimantan, yet its counterfactual scenarios should not be presented as directly observed effects of an Indonesian PLTB subsidy. A 2026 counterfactual assessment of thousands of canal blocks finds heterogeneous effects and indicates that well-sited hydrological interventions outperform average installations. These results provide an important analogue: the relevant public-finance benefit is the marginal difference caused by implementation at particular locations, not the nominal cost or number of interventions. The same principle should govern machine-sharing grants, firebreaks and other forms of PLTB support (Horton et al., 2022; Castro et al., 2026). Performance heterogeneity also changes the ethics of targeting. The highest expected public returns may occur in areas where smallholders face costly implementation obstacles; excluding them because of limited paperwork can undermine both equity and efficacy. On the other hand, paying well-capitalised beneficiaries who were already using PLTB can generate low additionality. Good targeting therefore requires at least three layers: verified legal and ecological eligibility, measured constraints to adoption, and a landscape-level assessment of expected risk reduction. Research into equitable restoration and stakeholder perceptions shows why public acceptability and locally meaningful definitions of success must be considered in the final allocation decision (Toumbourou et al., 2024; Ward et al., 2020; Grover et al., 2024).

7. Theme Seven: Integrated Governance Determines Durability

Prevention finance operates within the broader institutional infrastructure of peat restoration. Indonesia's three broad restoration activities—rewetting, revegetation and revitalisation of livelihoods—imply that no-burn preparation should support, not replace, hydrological management and viable rural enterprises. Reviews of tropical forest and peatland restoration discuss the difficulty of harmonising institutions, ecological targets and local livelihood

outcomes, while case studies reveal that a restored site's performance depends on maintaining infrastructure and community support after initial installation. This makes long-term maintenance and coordination a cost category, not an optional follow-up to capital expenditure (Yuwati et al., 2021; Indrajaya et al., 2022; Yuwati et al., 2026). Forest restoration experiments further indicate that nursery outputs and outplanting success are not equivalent, underscoring the need to assess outcomes beyond immediate project completion (Harrison et al., 2023). Restoration projects can also fail when technical indicators dominate social outcomes. Community fire-prevention action research, assessments of ecological and social restoration dimensions, and locally grounded analyses of post-fire networks all point toward arrangements that retain public accountability while supporting practical farmer participation. Rewetting designs may require collective water management across several ownership categories. Alternative land-use models must create commercially viable production or livelihood pathways, rather than promising climate and conservation gains without a transition budget. These findings jointly support a bundled policy in which targeted PLTB finance is nested within landscape institutions and evaluated over several fire seasons (Purnomo et al., 2024; Grover et al., 2024; Wulandari et al., 2021; Applegate et al., 2022; Usup et al., 2021). Table 2 summarises the strength and limits of the main evidence types informing the review. It links what a class of studies observes to what its findings can and cannot justify in the design of a PLTB incentive programme (Alexandra et al., 2026; Castro et al., 2026).

Table 2. Evidence-to-Policy Matrix and its Inference Limits

Evidence stream	Establishes	Cannot establish alone	Practical implication
Fire and climate mapping	Locations and periods of high hazard	Incentive-caused fire reduction	Spatially stratify programme eligibility
Household and governance studies	Constraints, compliance and legitimacy	Avoided national response expenditure	Design fair, feasible incentives
Hydrology and restoration studies	Biophysical risk-reduction mechanisms	The distinct marginal effect of PLTB support	Integrate drainage/rewetting actions
Cost and health assessments	Exposure and potential economic damages	Site-specific fiscal cash savings	Separate fiscal and social accounts
Counterfactual impact evaluation	Attributable difference if well-designed	Transferability to all Indonesian landscapes	Pilot, measure and adapt

The matrix illustrates why programme learning must combine ecological field data, governance assessments and credible causal evaluation. As the matrix makes explicit, none of these evidence streams alone establishes the complete fiscal and social benefits of a prevention subsidy; their integration can

progressively narrow uncertainty and improve accountability (Yuwati et al., 2026; Robins et al., 2022).

DISCUSSION

1. A Decision Rule for Incremental Fiscal and Societal Benefits

The appropriate comparison begins with a counterfactual. Define a treated decision unit, such as a farm cluster or a hydrologically coherent landscape, over a specified period. Let p_0 denote the probability of a consequential fire event without the incentive and p_1 the corresponding probability with the whole prevention package. Let Lf be the avoidable public response expenditure conditional on that event, while S represents incremental public transfer payments and A represents incremental public operating and verification costs not already included in S, all measured for the same unit and time horizon. The simplified fiscal net-benefit identity is set out in Equation (1). This identity applies directly only when the event and cost categories are consistent and programme effects do not materially change cost conditional on fire; where intensity also changes, an event-severity distribution is needed instead. It is an appraisal structure, not an empirically estimated coefficient (Baylis and Boomhower, 2023; Castro et al., 2026).

$$FNB = (p_0 - p_1) \times L_f - S - A \quad (1)$$

A broader societal identity requires different cost treatment. Let G denote the real incremental farm-level resources required for PLTB, net of resources that would otherwise be used for burning and excluding public service costs included in A, and let Ls represent other real losses per consequential event: property destruction, illness, ecosystem damage and valued carbon emissions not already included in Lf. Equation (2) expresses the simplified social net benefit, where O denotes additional real opportunity, transition and environmental costs that have not been counted elsewhere. The transfer S moves purchasing power and is not in itself another real cost in a conventional aggregate social account, although public financing has administrative and distortionary consequences that may require a separate shadow price. This distinction prevents an overly pessimistic societal analysis that counts both government subsidies and the same labour and equipment resources as independent costs (Januar et al., 2023; Jalilov et al., 2025).

$$SNB = (p_0 - p_1) \times (L_f + L_s) - G - A - O \quad (2)$$

For multi-season programmes, each annual risk difference, avoidable expenditure and programme cost should be discounted using a transparent real discount rate, and the result should be reported as an expected present value. This requires explicit treatment of time-varying drought hazard, continued machinery maintenance, end-of-period salvage values and any persistence or displacement of fire risk; the single-period expressions are not substitutes for that longitudinal appraisal (Januar et al., 2023; Jalilov et al., 2025).

2. Illustrative Break-Even Thresholds and Source-Note Ranges

Setting Equation (1) to zero yields the minimum attributable probability reduction required for fiscal break-even, shown in Equation (3). Suppose, strictly as an illustration, that a public support-and-verification package costs IDR 5 million per comparable treated unit. If an attributable, avoidable consequential-fire event would cost IDR 50 million in response expenditure, risk must fall by 10 percentage points for the package to break even on a fiscal basis. If that cost were IDR 100 million, the threshold would be five points; if IDR 200 million, 2.5 points. The threshold doubles if the programme cost doubles, and increases dramatically when the actual avoidable share of response expenditure is small. None of these combinations estimates the reduction actually caused by PLTB. They merely expose the risk-effectiveness information required before asserting value for money.

$$\Delta p^* = (S + A) / L_f \quad (3)$$

Risdiyanto's (2026) indicative IDR 50–200 million range must not be substituted into this identity automatically. It was presented as an indicative expenditure intensity per burned hectare in severe response conditions, not as a measured cost per probabilistic fire event facing an otherwise identical PLTB treatment unit. A landscape programme needs a mapping from farm-level ignition to expected area, duration, suppression intensity and jurisdictional spending. It also requires baseline probability over a stated period, the treatment's marginal effect, and whether helicopters or mobilisation would truly be avoided. Without these links, even a dramatic comparison between IDR 5 million of preparation and IDR 100 million of response demonstrates only a potential economic asymmetry, not a proven return on spending (Kiely et al., 2021; Puspitaloka et al., 2021; Baylis and Boomhower, 2023). Figure 2 visualises how a stylised IDR 5 million programme cost changes the break-even requirement as conditional, *avoidable* response costs vary. Each point on the curve is an assumption-driven threshold and cannot be interpreted as evidence of a particular programme's actual effect on fire probabilities (Baylis and Boomhower, 2023; Kiely et al., 2021).

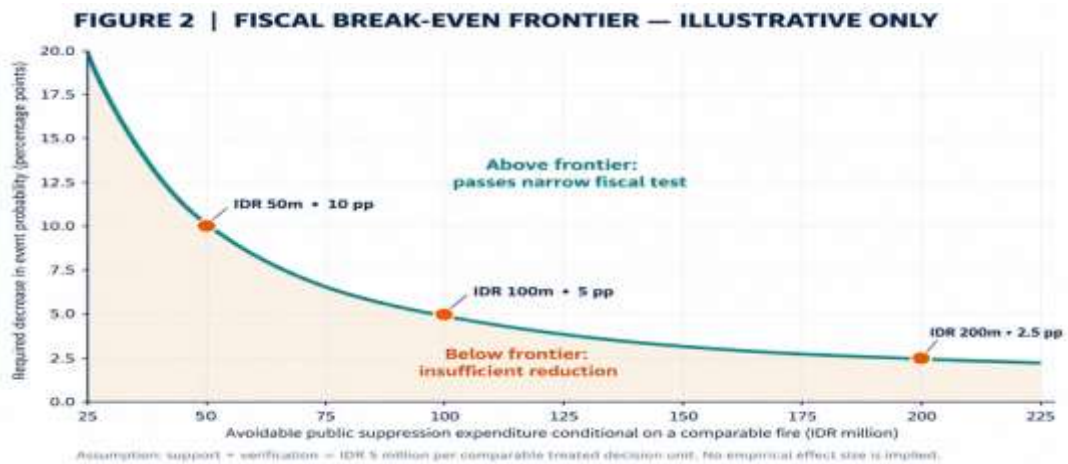


Figure 2. Illustrative Public-Budget Break-Even Frontier With Assumed IDR 5 Million Support Cost Per Comparable Decision Unit.

The descending frontier makes two practical lessons visible: higher genuinely avoidable response losses lower the necessary risk reduction, but a policy still fails the narrow fiscal test if its causal effectiveness falls below the frontier. Conversely, modest response savings do not necessarily make a programme socially undesirable because health, ecosystem and livelihood benefits may be important in a separately specified social analysis (Hein et al., 2022; Januar et al., 2023). The curve represents a threshold equation rather than a prediction interval, and its horizontal values refer to the avoidable public cost of a comparable event rather than the expenditure per hectare reported in the source note. The three displayed coordinates—IDR 50 million with 10 percentage points, IDR 100 million with five points, and IDR 200 million with 2.5 points—are arithmetic illustrations under the same IDR 5 million programme-cost assumption.

3. Risk-Adjusted Targeting Rather Than a Uniform Hectare Transfer

A defensible eligibility process begins with ecological risk and lawful land-use status. Priority landscapes can be identified from peat depth, degradation, canal density, historic fire frequency, climatic exposure and proximity to vulnerable communities. Within these landscapes, participating farmers can be assessed for incremental cost and liquidity constraints. Different mechanisms should be considered: grants for verified services, subsidised group machinery, contractor payments, accessible short-term credit, or equipment managed by farmer cooperatives. A simple per-hectare voucher may remain appropriate for standardised activities, but should have a cost ceiling and independent verification to avoid inflation of invoices or expansion incentives. Ecological mapping and climate-oriented models are useful screens, not evidence of individual culpability (Anda et al., 2021; Santika et al., 2020; Fauziah et al., 2025).

The support formula can be treated as the lesser of eligible incremental implementation cost and an administratively established public co-financing ceiling, adjusted for poverty, technical difficulty and marginal landscape risk. A programme might cover a larger share of verifiable expenditure for capital-constrained households while requiring stronger private co-financing from commercially capable operators. These criteria need transparent appeal routes and outreach so that informal or customary land users are not automatically rendered invisible. However, support must not regularise illegal deforestation, incentivise newly cleared peatland or displace enforcement of existing land protections. This balance respects both the economic constraints documented in field studies and the risks of poorly structured payment schemes (Ekawati et al., 2024; Abdurrahim et al., 2023; Resosudarmo et al., 2023).

4. The Programme Should Finance Verifiable Practices, Not Merely Absence of Fire

The absence of a satellite fire detection is an imperfect performance indicator: a parcel may not have burned because of rainfall, because no preparation took place, or because fire remained below a sensor's detection threshold. Conversely, a farmer may have complied with PLTB yet suffer a fire spreading from a neighbouring concession. Therefore, disbursement should link to verifiable preparation actions and reasonable risk-management obligations rather than guarantee zero fires. Suitable indicators include geo-referenced eligible parcels, before-and-after preparation documentation, equipment-service receipts, field inspections, firebreak upkeep, farmer-group logs and compliance with local hydrological protection rules. Remote-sensing evidence should triangulate rather than replace direct observation (Zahro et al., 2025; Krisnawati et al., 2023; Robins et al., 2022). Performance contracts should also avoid unfairly penalising households for climatic anomalies or exogenous shocks. A practical design separates an upfront access component from a verified-completion payment and a modest group-level maintenance bonus, subject to grievance procedures. Random audits, public disclosure of recipients and supplier prices, and clear conflict-of-interest rules can contain opportunistic claims. Independent complaint handling is particularly important where village elites mediate eligibility and commercial concessions influence water management. A transparent contract can thereby connect service delivery to a measurable public purpose while recognising that eventual fire risk is shared across landowners and institutions (Carmenta et al., 2021; Astuti, 2021; Purnomo et al., 2024).

5. Hydrological and Livelihood Complementarities

PLTB is not a replacement for ecological restoration. Where peat drainage has increased flammability, programmes should coordinate no-burning agricultural preparation with canal management, rewetting, protection of intact peat swamp forests and technically appropriate revegetation. Rewetting trials demonstrate how raising groundwater tables can reduce subsidence, while peat-restoration studies show that benefits depend on location and infrastructure performance. Cumulative protection may be greater when several measures are deployed together, but analysts should estimate their joint incremental impact to avoid attributing the same fire reduction to multiple budgets. Restoration costs also need differentiation between one-time works and ongoing maintenance or alternative livelihood assistance (Hooijer et al., 2024; Castro et al., 2026; Tan et al., 2022). The agricultural transition itself must be economically plausible. Paludiculture, agroforestry and lower-drainage cropping systems offer options to preserve livelihood opportunities while reducing ecological pressure, but adoption depends on markets, infrastructure, skills and crop suitability. Restoration may involve short-term income sacrifices and new exposure to price risk. Payment design should therefore include extension and working-capital support rather than treating a one-off clearing subsidy as the entire cost of transition. Equitable restoration principles emphasise participation, negotiated objectives and fair treatment of households whose subsistence or cultural

practices are affected by restrictions (Uda et al., 2020; Applegate et al., 2022; Toumbourou et al., 2024; Yunus et al., 2025).

6. Budget Reform and the Distinction Between Preparedness and Transferable Savings

Prevention finance need not imply stripping emergency agencies of necessary response capacity. The budgetary question is what share of future *variable* emergency costs can be avoided and what stable preparedness capacity should remain regardless of realised fires. Fixed equipment, training, personnel and early warning often generate value even when no incident takes place. A more defensible allocation begins with a transparent account of recurring prevention, readiness, response and recovery functions, then pilots a modest prevention envelope accompanied by protected essential response capability. Evidence of measured reductions in outsourced aircraft services, emergency logistics or overtime could later justify changing the composition of spending. The same logic applies to district, provincial and national government layers, because one level may finance prevention while another receives the fiscal benefit (Baylis and Boomhower, 2023; Purnomo et al., 2021). A public-finance mechanism can address that cross-level mismatch through conditional grants, jointly financed landscape plans and performance reporting. Fiscal rules should not pay only for the absence of visible fire, which is difficult to attribute in wet years, but can include independently confirmed hectares prepared without burning, maintenance of shared machinery and hydrological indicators. Annual financial reporting should distinguish committed funds, cash disbursements, actual real resource costs and reductions in verified emergency spending. The long time horizon of ecological interventions calls for multiyear financing, whereas adaptive annual adjustment can respond to weather, uptake and new estimates of additionality. Such separation improves auditability and reduces the political temptation to present all emergency appropriations as cash available to redirect (Januar et al., 2023; Jalilov et al., 2025; Yuwati et al., 2026).

7. Causal Evaluation: Measuring the Fires that Did Not Happen

The hardest empirical requirement is demonstrating the counterfactual. Administrative data on PLTB uptake cannot establish avoided ignition if participating villages differ systematically from non-participants in motivation, land-use rights, investment or previous fire experience. Evaluations should therefore prospectively identify comparable treatment and comparison landscapes and, wherever feasible, use phased implementation, randomised access among eligible groups, matched difference-in-differences designs or transparent synthetic comparisons. Outcomes should include ignitions, burned area, peat moisture, response spending, smoke exposure and farm welfare, with pre-specified estimands and controls for ENSO and land-use changes. Analyses should also monitor displacement: suppressing fire on registered plots while pushing agricultural clearing into nearby unregistered areas would undermine additionality (Edwards et al., 2020; Santika et al., 2020; Castro et al., 2026). Staggered adoption must be analysed carefully: if earlier-treated villages differ

from later-treated villages, a pooled two-way fixed-effects coefficient may place misleading weights on heterogeneous effects (Goodman-Bacon, 2021). Cohort-specific difference-in-differences estimators and explicit event-study diagnostics offer more transparent alternatives, conditional on defensible comparison trends and no uncontrolled spillovers across landscape boundaries (Callaway and Sant'Anna, 2021; Roth et al., 2023).

Measurement must occur at multiple scales. Plot-level documentation establishes the delivered activity; village-level analysis captures coordination and labour-market effects; hydrological-unit analysis captures water flows and fire spread; and regional analyses assess haze and response budgets. Financial outcomes require access to line-item spending and operational records with incident identifiers, not just broad annual appropriations. Health and carbon assessment requires separately attributed exposures and emissions consistent with location and timing. Researchers should publish uncertainty ranges and identify the difference between modelled fire reductions, causally estimated programme effects and administratively observed outputs. The recent growth of peatland remote sensing and emissions methods makes such integrated evaluation more feasible, but cannot replace sound identification (Zahro et al., 2025; Hein et al., 2022; Krisnawati et al., 2023).

8. Interpreting Divergent Evidence Rather Than Searching for One Coefficient

The literature does not offer a universal estimate of the effect of PLTB incentives. Findings on programme packages, hydrological restoration and enforcement differ because they concern different mechanisms and contexts. In a setting of strong existing compliance, an additional cash payment may have limited additionality; where safe preparation equipment is inaccessible, direct service provision may produce substantial behavioural change. Some fire-control gains will arise from improved drainage management or land protection rather than preparation technology per se. The proper conclusion is that policy instruments should be selected according to their local causal mechanism and combined when interactions warrant it. A narrative review can make those interactions explicit without falsely pooling studies with incompatible exposures, outcomes and methods (Carmenta et al., 2021; Resosudarmo et al., 2023; Horton et al., 2022; Castro et al., 2026). The comparison also reveals a two-sided risk of policy failure. Underinvestment in prevention leaves households choosing privately affordable but collectively dangerous strategies, while poorly targeted overinvestment may subsidise behaviour that would already have occurred. The middle path is disciplined experimentation with strong governance: establish risk baselines, provide accessible and credible alternatives, verify delivery, estimate incremental prevention, and adjust financing based on evidence. Incorporating farmers' relational values, social networks and ecological objectives makes the programme more legitimate, although these considerations cannot substitute for measurement of fire outcomes. A credible prevention programme should report both equity and risk reduction, including trade-offs when the highest-risk landscapes are not those easiest to serve (Ward et al., 2020; Wulandari et al., 2021; Abdurrahim et al., 2023; Yunus et al., 2024).

9. Policy Roadmap and Research Priorities

A staged rollout would begin with a diagnostic phase: map peat and non-peat landscapes, establish lawful eligibility, document local PLTB technology costs and disaggregate recent suppression expenditure by incident. Next, a co-design phase would engage smallholders, local governments, fire brigades, scientists, customary representatives and concession holders to agree on equipment-sharing and eligibility protocols. A pilot phase would finance verified non-burning preparation at high-risk sites, with explicit safeguards against land expansion and independent controls. After two or more contrasting fire seasons, evaluation should compare participants with credible controls and publish the marginal public spending effects, welfare outcomes and uncertainty. Only then should programme rules and financing volumes be expanded (Purnomo et al., 2024; Robins et al., 2022; Yuwati et al., 2026).

Figure 3 translates the proposed prevention-first principle into a sequence of public decisions and information flows. The architecture combines risk diagnosis, equity screening, a delivery contract, cross-sector restoration and verified outcomes, with a feedback arrow requiring adjustment rather than automatic programme expansion (Purnomo et al., 2024; Robins et al., 2022).



Figure 3. Adaptive Implementation Sequence With Continual Independent Audit and Protected Firefighting Capacity

The figure stresses that responsive emergency capacity remains intact while conditional PLTB support is tested. Public reporting should separate observed participation from measured additional effects on fire, and audits should examine financial transfers and real resource use separately. A failed evaluation should trigger changes in intervention design or withdrawal from a particular site, not a presumption that all prevention spending must be effective (Carmenta et al., 2021; Castro et al., 2026). Future research should prioritise actual incremental per-hectare costs across soil types, farm sizes and methods; identify which activities change ignition versus spread; estimate the avoidable portion of government response expenditure; and test the effectiveness of different payment and service-delivery mechanisms. Additional work should quantify

landscape spillovers, health exposure consequences and emissions without double counting, while examining tenure-related exclusion and differential impacts on women and poorer households. Investigators should collect costs before and after adoption rather than relying on retrospective opinions and maintain comparable definitions across provinces. Such a programme of research would turn an intuitively attractive prevention-first argument into a defensible evidence-based fiscal policy (Kiely et al., 2021; Phung et al., 2022; Jalilov et al., 2025; Yuwati et al., 2026).

CONCLUSIONS AND RECOMMENDATIONS

The main insight of this review is that fire prevention should be financed according to additional, risk-adjusted public and social value, not a direct subtraction between the nominal cost of PLTB on a prepared hectare and the observed cost of responding to a fire on a burned hectare. Farmers' immediate preparation decisions, government emergency accounts and public exposure to haze and carbon damage belong to different decision and accounting systems. A coherent policy framework connects them through a clearly defined counterfactual, evidence about programme effectiveness, comparable units of analysis and equitable allocation of intervention costs. The scientific literature supports strong attention to risk concentration, peat hydrology, affordable alternative practices, institutional legitimacy and the potentially large social consequences of fire. It does not establish that a uniform hectare incentive will deliver fiscal savings everywhere, nor does it validate a single national response-cost tariff. Prevention packages are most credible when targeted to lawful, high-risk landscapes, designed around real farmer constraints, integrated with hydrological management and supported by transparent monitoring, grievance mechanisms and sustained public capacity. The recommended course is a staged, independently evaluated PLTB support programme with protected emergency readiness, careful differentiation between financial transfers and real resource costs, explicit safeguards against adverse land-use change and publication of both fiscal and social outcomes. This approach can transform prevention finance from an appealing arithmetic analogy into a testable and accountable instrument for reducing destructive fires while supporting equitable rural transitions.

FURTHER STUDY

This study still has its limitations, so more research on 'From Reactive Fire Suppression to Risk-Adjusted Prevention: Financing Fire-Free Land Preparation in Indonesia's Peatland Landscapes' is needed to refine this study and give extra insights for the writer and readers.

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