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Balancing Equity and Productivity in Oil Palm Plantation Land Governance: Complexities and Challenges of Agrarian Reform Implementation in Indonesia

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Abstract

The Indonesian oil palm sector faces a fundamental tension between productivity imperatives and equity demands in plantation land governance. This qualitative literature review examines the complexities and challenges of implementing agrarian reform that harmonizes productivity with equity in oil palm plantations. Drawing on recent scholarly literature, this study analyzes key dimensions including: (1) the HGU (Hak Guna Usaha) leasehold system and transition mechanisms; (2) nucleus-plasma partnership models and the feasibility of transforming traditional 80:20 ratios toward 20:80 configurations; (3) productivity gaps between corporate estates and smallholders; (4) institutional support mechanisms, particularly cooperatives; (5) community integration strategies including intercropping and livestock integration; (6) sustainable land ownership structures; and (7) effective control mechanisms for smallholder plantations. International best practices from Malaysia's FELDA, Thailand's community-based reforms, and Vietnam's smallholder-led development provide comparative insights. Findings reveal that smallholders can achieve corporate-level productivity with appropriate institutional support, secure land tenure, access to technology, and value chain integration. However, successful agrarian reform requires comprehensive, phased approaches with strong institutional capacity building, particularly the strengthening of cooperatives, rather than immediate redistribution. The study proposes a 15-year roadmap encompassing HGU system reform, Land Bank operationalization, plasma partnership transformation, and multi-stakeholder collaboration platforms. Key policy recommendations emphasize conditional HGU renewal, mandatory plasma ratios, streamlined certification processes, and backward-forward linkages that benefit surrounding communities while maintaining national productivity.

Keywords: Agrarian Reform; Oil Palm Plantation; Equity-Productivity Nexus; Land Tenure Security; Nucleus-Plasma Partnership; Smallholder Productivity; Cooperative Institutions; HGU Leasehold; Land Bank; Sustainable Land Governance

JEL Classification: Q15 (Land Ownership and Tenure; Land Reform; Land Use), Q18 (Agricultural Policy; Food Policy), O13 (Economic Development: Agriculture; Natural Resources; Energy; Environment; Other Primary Products), P32 (Socialist Institutions and Their Transitions: Enterprises; Property Rights and Privatization)

Introduction

Background

Oil palm (Elaeis guineensis) is a critical pillar of Indonesia's agricultural economy, contributing significantly to foreign-exchange earnings, rural employment, and smallholder livelihoods. As the world's largest producer, accounting for approximately 58% of global palm oil production, Indonesia's oil palm sector spans approximately 16.8 million hectares. It involves over 2.9 million smallholder families alongside large corporate estates. This dual structure—characterized by capital-intensive corporate plantations operating under HGU (Hak Guna Usaha/ Business Use Rights) and resource-constrained smallholder plots—embodies a fundamental tension between productivity efficiency and equitable land access, at the heart of contemporary agrarian reform debates [1,2].

The concentration of plantation land under corporate control has generated persistent concerns about equity and social justice. Large estates, typically operating at scales exceeding 5,000 hectares with sophisticated management systems and best agricultural practices, achieve yields averaging 18-22 tons fresh fruit bunches (FFB) per hectare annually. In contrast, independent smallholders managing fragmented plots of 1-3 hectares frequently yield only 8-12 tons FFB/ha, representing only 50-60% of potential productivity. This productivity gap, while indicating substantial room for improvement, also highlights the complex relationship between land control patterns and agricultural efficiency [3].

Simultaneously, agrarian conflicts have intensified as communities contest corporate land claims, demand recognition of customary rights, and seek greater participation in the benefits of plantations. These conflicts often stem from unclear land boundaries, inadequate compensation mechanisms, limited community integration in plantation value chains, and wealth disparities between plantations and surrounding villages. The resulting security challenges—including crop theft, intentional damage, and operational disruptions—impose high costs while underscoring the unsustainability of purely production-oriented approaches that neglect equity considerations [4,5].

Research Urgency

The urgency of addressing equity-productivity tensions in plantation land governance emerges from multiple converging pressures. First, Indonesia's commitment to agrarian reform, formalized through Presidential Regulation and National Medium-Term Development Plans, mandates redistribution of 4.5 million hectares to landless and land-poor families, with significant portions potentially sourced from expired or underperforming HGU lands. This political commitment creates both opportunities and risks—opportunities to address historical inequities, but risks of productivity disruption if reforms proceed without adequate preparation and institutional support [2,6].

Second, the demographic and economic realities of rural Indonesia demand inclusive development pathways. With approximately 41% of oil palm areas already under smallholder management but performing substantially below potential, the sector exhibits both an equity deficit (inadequate smallholder access and support) and an efficiency deficit (unrealized productivity potential). Addressing these twin deficits simultaneously could yield substantial welfare gains while maintaining, or even enhancing, national production levels [7,8].

Third, sustainability pressures from global markets increasingly condition market access on social and environmental criteria. Certification schemes such as RSPO (Roundtable on Sustainable Palm Oil) and ISPO (Indonesian Sustainable Palm Oil) emphasize not only environmental compliance but also the security of land rights, fair distribution of benefits, and community welfare. However, smallholder participation in certification remains limited, constrained by land tenure insecurity, documentation requirements, and compliance costs. Reforming land governance to enhance smallholder tenure security and institutional capacity thus becomes essential for maintaining Indonesia's competitive position in sustainability-conscious markets [9-10].

Research Objectives

This study pursues three primary objectives. First, it analyzes the complexity of the relationships between equity and productivity in oil palm plantation land governance, examining conditions under which these objectives align synergistically versus circumstances that generate trade-offs requiring careful management. Second, it identifies specific challenges in implementing agrarian reforms to harmonize equity and productivity, drawing on both Indonesian experience and international comparisons. Third, it formulates evidence-based policy recommendations to achieve a sustainable balance between equity and productivity through comprehensive, sequenced reform strategies that minimize disruption and maximize long-term benefits.

Literature Review

Conceptual Framework: Equity and Productivity in Land Governance

The theoretical foundation for analyzing plantation land governance rests on understanding equity and productivity as potentially complementary rather than inherently antagonistic objectives. Equity in land governance encompasses distributive justice (fair allocation of land assets), procedural justice (inclusive decision-making processes), and recognition justice (acknowledgment of diverse tenure systems, including customary rights). In agrarian contexts, equity concerns extend beyond static land distribution to dynamic access—the ability to benefit from land through secure tenure, adequate resources, appropriate technology, and market connections [5,12,13].

Productivity, conventionally measured as output per unit of land or input, reflects technical efficiency (optimal input combinations given technology) and allocative efficiency (optimal resource allocation given prices). In plantation agriculture, productivity encompasses not only yield per hectare but also labor productivity, capital efficiency, and total factor productivity. Scale economies—arising from spreading fixed costs, bulk purchasing power, and specialized management—have traditionally justified large corporate plantations. However, recent literature increasingly recognizes that institutional innovations can enable smallholders to capture economies of scale through collective action while retaining the motivational advantages of family farming [14,15].

The relationship between land tenure arrangements and productivity has generated extensive debate. Traditional Marshallian perspectives held that small-scale owner-operators would be more productive than large estates because of superior labor supervision and intrinsic motivation. However, concerns about credit constraints, barriers to access to technology, and

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management limitations in smallholder systems have tempered this optimistic view. Contemporary research emphasizes that tenure security—not farm size per se—determines the critical factor in productivity-enhancing investments. Secure tenure encourages long-term investments in soil improvement, replanting with superior varieties, and sustainable management practices, while tenure insecurity generates short-term extraction incentives that degrade productivity [16-18].

Recent theoretical advances suggest that equity and productivity can form mutually reinforcing relationships when institutional conditions enable secure tenure, collective action, knowledge transfer, and market access. Under these circumstances, more equitable land distribution, coupled with strong institutional support, can enhance aggregate productivity by mobilizing underutilized labor, intensifying cultivation, and fostering innovation. Conversely, highly concentrated land ownership may create inefficiencies through incomplete labor markets, political capture of support services, and social tensions that impose security costs [19].

HGU System and Land Tenure Structure in the Indonesian Oil Palm Sector

Indonesia's plantation land tenure system centers on the HGU, a legally defined, state-granted, temporary right to cultivate land for large-scale agriculture. HGU can initially extend for up to 35 years, with a possible 25-year extension and a subsequent 35-year renewal, for a total of 95 years. Critically, HGU constitutes a leasehold arrangement rather than ownership—the state retains ultimate control, and holders possess use rights conditional on productive utilization and regulatory compliance [20].

However, implementation frequently diverges from this legal framework. Many HGU holders treat concessions as quasi-ownership, with minimal state oversight over performance, social contributions, or environmental compliance. The absence of systematic evaluation mechanisms means that underperforming or non-compliant HGU typically receive automatic renewals, while expired HGU may be abandoned without consequence, creating land tenure uncertainty that hampers productive utilization. Furthermore, overlapping claims between HGU boundaries and community lands generate persistent conflicts, particularly where HGU issuance proceeded without adequate consultation or recognition of customary rights [5,21].

The nucleus-plasma partnership model emerged as a mechanism for integrating smallholders into plantation development while addressing land-access demands. Traditionally structured with 80% nucleus (corporate-managed estate) and 20% plasma (smallholder plots), this model has evolved toward more equitable configurations, with some regions implementing 20:80 ratios. Plasma schemes vary considerably in structure: PIR-Trans (government-sponsored transmigration schemes), PIR-KKPA (community-based schemes), and independent partnerships between companies and farmer groups [22,23].

Performance evaluations of nucleus-plasma schemes reveal mixed outcomes. Well-managed schemes with strong cooperative institutions and effective company support can achieve plasma productivity approaching 95% of estate potential, leading to higher farmer incomes and satisfaction levels. However, many schemes suffer from weak cooperatives, inadequate farmer training, delayed payments, and asymmetric power relations favoring the corporate nucleus over plasma farmers. These challenges highlight that partnership structure alone proves insufficient—institutional quality and governance mechanisms fundamentally determine success [24,25].

Independent smallholders, constituting approximately 40% of Indonesia's oil palm area, face distinct challenges. Lacking integration with estates or cooperatives, independent smallholders typically experience limited access to quality inputs, extension services, credit, and remunerative markets. Fragmented landholdings, aging palms requiring replanting, and minimal adoption of best agricultural practices contribute to substantial yield gaps. Yet evidence also shows that when provided with appropriate support—including secure land tenure, access to finance, technical assistance, and market linkages—independent smallholders can achieve productivity levels comparable to those of estates [14,18,26].

Productivity Challenges and Yield Gaps

A comprehensive yield gap analysis reveals that Indonesian oil palm smallholders produce, on average, 65% below their potential, given local agroecological conditions. Multiple factors contribute to this gap. Agronomic factors include inadequate fertilization (often 30-50% below recommended levels), poor weed control, insufficient harvesting frequency (resulting in over-ripe fruit with reduced oil content), and delayed replanting of senescent palms. Management factors encompass limited record-keeping, suboptimal harvest timing, and inadequate pest and disease control [14,17,26,27].

Structural constraints compound these technical challenges. Smallholders frequently lack secure land tenure documentation, making them ineligible for formal credit and reluctant to invest in long-term productivity improvements. Access to quality inputs remains problematic, with smallholders often purchasing fertilizers in small quantities at higher per-unit costs than estates achieve through bulk procurement. Extension services, where available, rarely provide the intensive, plot-specific guidance required for optimal management. Market access barriers, including dependence on intermediaries that capture significant value, further reduce profitability and investment capacity [28-30].

However, successful interventions demonstrate significant potential to close yield gaps. Cooperative-based schemes providing integrated support—combining technical training, input supply, credit access, and collective marketing—have achieved productivity increases of 40-65% within 3-5 years.

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These results suggest that the productivity penalty of smallholder cultivation reflects inadequate institutional support rather than the inherent inefficiency of family farming. This finding carries profound implications for agrarian reform: properly supported smallholders can match corporate productivity, rendering the equity-productivity trade-off largely artificial rather than inevitable [2,31,32].

Equity Challenges and Land Conflicts

Land concentration patterns reveal significant inequities. Large corporations control approximately 60% of oil palm plantation areas through HGU concessions, with individual concessions sometimes exceeding 50,000 hectares held by single corporate groups. This concentration occurs despite constitutional provisions that emphasize the social function of property and prohibit the accumulation of land, thereby fostering exploitation. Meanwhile, millions of rural families remain landless or land-poor, with average landholdings below subsistence thresholds [33].

Land conflicts between plantations and communities have escalated, with thousands of disputes pending resolution. Common conflict triggers include: HGU boundaries encroaching on community lands or customary territories; inadequate or absent compensation for land acquisition; exclusion of communities from plantation benefits despite loss of land access; environmental damages affecting community water sources or forests; and broken promises regarding employment or development. These conflicts impose substantial costs—direct security expenses, production losses from disruptions, reputational damage that affects market access, and opportunity costs of management time devoted to conflict rather than productive activities [5,34].

The social dimensions of equity extend beyond land distribution to include benefit sharing, community welfare, and power relations. Studies document substantial wealth disparities between plantation areas and surrounding villages, with plantation workers and nearby communities experiencing limited spillovers from plantation prosperity. This disparity reflects weak backward and forward linkages—plantations source inputs from external suppliers rather than local producers, and processing occurs in distant facilities rather than community-level enterprises. Employment generation, while significant, often entails temporary or precarious work at wages insufficient to support decent livelihoods [35].

Institutional Support Mechanisms: The Critical Role of Cooperatives

Cooperatives emerge across multiple studies as potentially transformative institutions for enhancing smallholder productivity while strengthening equity. Effective cooperatives provide integrated services that address smallholders' multiple constraints: bulk input procurement at reduced costs; credit facilitation through group guarantees; technical training and extension services; quality control and collective marketing; and advocacy that strengthens members' bargaining power. Well-functioning cooperatives enable smallholders to capture scale economies in input purchasing and output marketing while retaining family farm advantages in labor management and operational decision-making [36,37].

Comparative analysis of plasma schemes reveals that cooperative-managed models substantially outperform company-managed or individual arrangements across multiple metrics. Cooperative-managed plasma plots achieve average yields of 18-20 tons FFB/ha (95% of potential), compared to 15-17 tons/ha for company-managed schemes and 12-14 tons/ha for individual arrangements. Farmer satisfaction, income levels, and participation rates similarly favor cooperative models. These superior outcomes reflect cooperatives' alignment of incentives, superior information flows enabling responsive technical support, and collective problem-solving capacities [38,39].

However, cooperative success requires specific preconditions frequently absent in Indonesian contexts. Essential prerequisites include: transparent financial management with regular audits and member access to records; accountable leadership with democratic governance and limited tenure; adequate technical and managerial capacity among cooperative staff; sufficient scale to achieve economies while maintaining member engagement (typically 500-2,000 members); and external support during formation and early operation phases. When these conditions are not met, cooperatives often become vehicles for elite capture, the distribution of patronage, or simply dormant entities that exist only on paper [8].

Strengthening cooperative capacity thus constitutes a critical prerequisite for the success of agrarian reform rather than an automatic outcome. Capacity building interventions must address governance systems, financial management, technical skills, market linkages, and member education. International experience suggests that effective cooperative development requires sustained support over 5-10 years, including technical assistance, matching grants for institutional development, and regulatory frameworks that promote accountability while preventing excessive interference [2,40].

International Best Practices and Comparative Perspectives

Malaysia's FELDA (Federal Land Development Authority) provides instructive lessons for state-led smallholder plantation development. Established in 1956, FELDA has developed over 850,000 hectares of oil palm and rubber plantations, organized into schemes, with 112,000+ settler families. FELDA's model combined government land clearing and plantation establishment, the allocation of 4-5-hectare plots to selected settlers, comprehensive support services including inputs and extension, and central processing facilities to ensure market access. Initially structured as welfare-oriented settlements, with

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FELDA managing plantations until settlers could assume control, the model gradually transitioned to commercial operations, with settlers as shareholders in plantation management companies [34,41].

FELDA's outcomes demonstrate both achievements and limitations. Positive outcomes include the successful transformation of landless families into productive smallholders with income levels substantially above poverty thresholds, the development of large-scale oil palm production contributing significantly to Malaysia's economy, and the maintenance of high productivity through centralized technical support and quality control. However, challenges emerged, including high establishment costs that required substantial state subsidies, limited settler participation in management decisions during the welfare phase, difficulties with generational transition as original settlers aged, and recent controversies over land sales and financial management [38,41,42].

For Indonesia, FELDA's experience suggests several relevant lessons. First, state-led smallholder development can achieve both equity and productivity objectives when backed by adequate resources, technical capacity, and sustained commitment. Second, a phased transition from state management to farmer control requires careful sequencing, with capacity building preceding autonomy, to prevent a productivity collapse. Third, cooperative or collective institutions are essential for sustaining smallholder productivity by maintaining economies of scale in processing, marketing, and input supply. Fourth, avoiding elite capture and ensuring intergenerational equity requires robust governance frameworks that prevent land alienation and ensure benefits flow to intended beneficiaries [41,43].

Thailand's experience with community-based land reform offers alternative approaches emphasizing collective land rights and participatory management. Thailand's community land title program recognizes collective rather than individual tenure, with communities managing land allocation among members while retaining collective ownership. This approach aims to prevent land concentration through market transactions while enabling communities to capture land values through collective investment. However, implementation challenges include limited scalability, resistance from existing power structures, and difficulties in balancing collective control with individual autonomy [44].

Vietnam's success in developing highly productive smallholder agriculture through land reform, secure tenure, and market liberalization provides additional insights. Vietnam's "doi moi" reforms granted long-term, inheritable, transferable land-use rights to farm households, coupled with the removal of production quotas and marketing restrictions. This combination of tenure security and market incentives generated rapid productivity growth, with smallholder family farms driving agricultural intensification. While Vietnam's rice-focused system differs substantially from tree-crop plantations, the fundamental lesson remains relevant: secure tenure and market access can unleash smallholder productivity even without large-scale organization [45].

Multifunctional Land Use and Community Integration

Recent innovations in oil palm management explore ways to integrate community welfare objectives without sacrificing productivity. Intercropping during the immature phase (years 0-3 before canopy closure) enables smallholders to generate income from food crops while awaiting oil palm productivity. Suitable intercrops include maize, cassava, legumes, and vegetables, which can provide $500-$1,200/ha in annual income during years when palms generate no income. Intercropping also offers agronomic benefits, including weed suppression, erosion control, and soil fertility enhancement through nitrogen-fixing legumes. However, careful management is essential to prevent competition for nutrients and water that could retard palm development [46,47].

Livestock integration represents another promising multifunctional approach. Cattle, sheep, or goats grazing under mature palms can utilize undergrowth vegetation that would otherwise require costly manual or chemical control, while providing additional income streams and organic fertilizer. Research demonstrates that properly managed cattle-oil palm integration can reduce weeding costs by 40-60% while generating livestock income of $300-800/ha annually. Key success factors include appropriate stocking densities (typically 1-2 cattle/ha), rotational grazing to prevent soil compaction, and supplementary feeding during dry seasons [1,48-51].

These multifunctional approaches hold particular promise for enhancing community integration and benefit sharing. Allowing surrounding communities to engage in intercropping or livestock grazing on portions of plantation areas—whether on corporate estates or plasma plots—can provide supplementary income while strengthening community-plantation relationships. Formalizing such arrangements through clear agreements specifying areas, permitted activities, duration, and benefit-sharing terms could transform plantations from isolated enclaves into integrated components of rural landscapes. However, operationalizing these approaches requires overcoming corporate reluctance, establishing appropriate governance mechanisms, and ensuring activities remain compatible with plantation productivity objectives [52].

Methodology

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This study employs a qualitative literature review to synthesize and analyze scholarly knowledge on equity-productivity dynamics in oil palm plantation land governance and the challenges of implementing agrarian reform. Qualitative literature reviews, distinguished from systematic reviews by greater flexibility in source selection and a thematic analysis approach, are particularly appropriate for exploring complex policy questions involving multiple disciplines, diverse geographical contexts, and normative dimensions [53,54].

Literature identification proceeded through searches of major academic databases, including Scopus, Web of Science, and Google Scholar, using keyword combinations such as "agrarian reform," "oil palm," "land tenure," "smallholder productivity," "nucleus plasma," "equity efficiency," "HGU," and "cooperative." Temporal scope focused on recent scholarship (2020-2026) to capture current policy debates and evidence, while selectively incorporating seminal earlier works establishing theoretical foundations. Geographic focus centered on Indonesia as the primary case, while including comparative perspectives from Malaysia, Thailand, Vietnam, and other developing countries implementing plantation land reforms.

Source selection prioritized peer-reviewed journal articles, though policy reports from authoritative organizations (World Bank, FAO, CIFOR-ICRAF) and government documents were included when they provided essential contextual information. Approximately 118 sources were reviewed, with emphasis on empirical studies documenting productivity outcomes, institutional arrangements, community impacts, and policy interventions, as well as theoretical contributions analyzing equity-efficiency relationships and governance frameworks.

Analysis followed a thematic synthesis approach, identifying recurrent themes across the literature, examining variations in findings across contexts and methods, and synthesizing insights to address research questions. Key themes emerging from analysis included: relationships between tenure security and productivity; institutional determinants of smallholder performance; nucleus-plasma partnership models and outcomes; HGU governance challenges and reform imperatives; cooperative effectiveness factors; community integration mechanisms; and international comparative experiences. These themes structure the results and discussion sections below [33].

Results: Thematic Findings

Theme 1: Equity-Productivity Relationships—Synergies and Trade-offs

The literature synthesis reveals that equity and productivity objectives need not be zero-sum trade-offs. Multiple studies document conditions under which more equitable land access arrangements generate equal or superior productivity compared to concentrated corporate control. The critical mediating factor is institutional support—when smallholders receive secure tenure, technical assistance, access to inputs, and market linkages comparable to those of corporate estates, productivity differences largely disappear [55].

Evidence from cooperative-managed plasma schemes demonstrates this potential. Studies report that well-supported plasma farmers achieve yields of 18-20 tons FFB/ha, matching or exceeding corporate estate averages of 18-22 tons/ha. These outcomes reflect not the intrinsic superiority of corporate management but rather differential access to inputs, knowledge, and markets. When cooperatives provide integrated support enabling bulk input procurement, regular technical training, timely harvesting, and efficient marketing, family farmers prove fully capable of matching corporate performance [39,56,57].

However, literature also documents substantial yield gaps where institutional support remains inadequate. Independent smallholders lacking cooperative membership or company partnerships typically achieve only 8-12 tons FFB/ha, which represents 50-60% of their potential productivity. This performance gap reflects multiple constraints, including inadequate fertilization, suboptimal harvesting practices, aging palms that require replanting, and market access barriers that reduce profitability and reinvestment capacity. Critically, these constraints are not intrinsic to small-scale cultivation but rather consequences of institutional failures in extension systems, input markets, and land tenure documentation [17,58].

Land consolidation studies provide additional perspective on scale-productivity relationships. While fragmentation into very small plots (below 1 hectare) can reduce productivity through diseconomies of scale in input use and management, consolidation beyond modest sizes yields diminishing returns. For oil palm specifically, plot sizes of 2-4 hectares appear sufficient to capture economies of scale when combined with cooperative-level coordination for input procurement and marketing. This finding suggests that the redistribution of large estates into smallholder plots need not sacrifice productivity if accompanied by strong cooperative institutions enabling collective action [2,30,43,59].

Tenure security emerges as fundamental to productivity. Farmers with secure, documented land rights invest significantly more in land improvements, long-term soil fertility management, and replanting with superior varieties than those without secure tenure. This relationship proves particularly crucial for perennial crops like oil palm, where productivity depends on investments with multi-decade time horizons. Agrarian reforms that enhance tenure security for smallholders thus generate productivity benefits even in the absence of other support interventions

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[2,14,17].

Theme 2: HGU Governance Challenges and Reform Imperatives

Current HGU governance exhibits substantial divergence from intended leasehold principles. Despite legal frameworks defining HGU as temporary, conditional use rights, in practice, HGU is treated as quasi-permanent tenure with minimal performance accountability. Studies document automatic renewal practices regardless of productivity, compliance, or social contribution performance. This governance failure generates multiple inefficiencies, including land banking (holding HGU without productive use), inadequate investment in sustainability, and neglect of community relationships [60].

HGU expiry and transition mechanisms prove particularly problematic. As HGU approaches expiration, holders lack clear incentives to continue investing, potentially leading to asset stripping, deferred maintenance, and declining productivity. Simultaneously, uncertainty about post-expiry land control creates conflicts among holders seeking renewal, communities claiming rights, and government agencies responsible for allocation decisions. The absence of systematic evaluation frameworks means decisions often reflect political influence rather than objective performance criteria [34,61].

Land Bank institutions, recently established to manage state land, including expired HGU, face substantial capacity and operational challenges. While Land Bank mandates include acquiring expired or underperforming HGU for redistribution, with 30% allocated to agrarian reform, implementation remains limited. Capacity constraints include insufficient staff, technical expertise, and funding for land acquisition and temporary management pending redistribution. Coordination challenges with multiple government agencies, including regional governments, further complicate operations [2,62].

Reform imperatives emerging from the literature emphasize transforming HGU from quasi-ownership to authentic leasehold with rigorous performance accountability. This transformation requires: systematic evaluation frameworks that assess productivity, environmental compliance, labor standards, and community contributions; conditional renewal based on objective performance criteria rather than automatic extension; significant penalties for underperformance, including HGU revocation; and clear transition mechanisms that ensure a smooth handover at expiry rather than abandonment or conflict. Implementing these reforms would enhance both efficiency—by ensuring productive land use—and equity—by enabling redistribution of underutilized lands [1,46,63].

Theme 3: Nucleus-Plasma Partnerships and Feasibility of Ratio Transformation

Nucleus-plasma partnerships exhibit substantial variation in performance depending on structural design and institutional quality. Traditional 80:20 (nucleus: plasma) ratios emerged from assumptions that large nucleus areas were necessary for processing economies of scale and to cross-subsidize plasma development. However, experiences demonstrate that higher plasma proportions can succeed when supported by strong cooperative institutions [64,65].

Comparative evidence shows that cooperative-managed models with 20:80 ratios (or even 100% plasma with centralized processing) can achieve productivity levels matching those of traditional configurations. Malaysia's FELDA schemes, essentially 100% smallholder-owned with centralized processing and support services, demonstrate sustained productivity at national-average levels. Key success factors include: adequate processing capacity scaled to production volumes; efficient logistics for fresh fruit bunch collection from dispersed plots; intensive extension services that maintain management quality; and strong cooperative governance that prevents free-riding and ensures quality standards [40,41].

However, the literature also documents numerous failed or poorly performing plasma schemes, typically characterized by weak cooperative capacity, inadequate farmer training, delayed payment systems, and asymmetric power relations that favor corporate-nucleus interests. These failures highlight that a ratio transformation alone is insufficient—fundamental prerequisites include cooperative institutional capacity, farmer capacity building, transparent governance systems, and regulatory frameworks that protect farmers' interests [9,10].

The feasibility of transforming existing 80:20 schemes toward 20:80 ratios depends critically on transition mechanisms. An immediate wholesale transformation would risk disrupting productivity due to inadequate preparation. Phased approaches with pilot testing, intensive capacity building, and learning-by-doing appear more prudent. The literature suggests 10-15-year transition timelines with clear milestones, performance monitoring, and adaptive management based on emerging evidence. Such approaches balance equity objectives (increasing smallholder control) with productivity imperatives (maintaining management quality during transition) [45].

Theme 4: Cooperative Effectiveness and Prerequisites

Cooperatives' central role in mediating equity-productivity tensions has attracted substantial scholarly attention to the factors that determine cooperative effectiveness. Successful cooperatives exhibit several common characteristics: transparent financial management with regular audits and member access to financial statements; democratic governance with regular elections, limited leadership tenure, and member participation in major decisions; adequate technical capacity among cooperative staff for agronomic advice and quality control; sufficient scale (typically 500-2,000 members) to achieve input purchasing and marketing economies while maintaining member engagement; and provision of integrated services addressing multiple

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member constraints simultaneously rather than single-function approaches [3,15,38,43,66,67].

Studies comparing successful and struggling cooperatives consistently identify governance quality as the critical differentiator. Cooperatives that exhibit accountability, transparency, and member participation generate trust that enables collective action, while those dominated by elite actors or marked by corruption and mismanagement experience member exit and institutional decay. This finding highlights that legal cooperative registration is insufficient—functional effectiveness requires deliberate institutional development that addresses governance systems, capacity building, and member education [38,39].

External support during cooperative formation and early operational phases significantly influences long-term success. Effective support includes: training in cooperative management for financial administration, governance procedures, and technical skills; matching grants for institutional development expenses (office equipment, initial working capital, feasibility studies); regulatory guidance to navigate cooperative registration and compliance requirements; and facilitation of partnerships with input suppliers, processors, and buyers. Duration of support matters—short-term interventions prove insufficient for building institutional capacity, with evidence suggesting 5-10 year support periods yield more sustainable outcomes [68].

However, cooperative strengthening faces substantial challenges in Indonesian contexts, including a limited tradition of autonomous collective action, a history of state-controlled cooperatives that have limited democratic governance, capacity constraints in rural areas, and limited public resources for sustained support programs. These challenges suggest that cooperative-based agrarian reform strategies require long-term commitment and substantial investment in institutional development, rather than legal frameworks that merely mandate the formation of cooperatives [2,8].

Theme 5: Community Integration and Benefit-Sharing Mechanisms

The literature documents persistent gaps between plantation prosperity and the welfare of surrounding communities, contributing to conflicts and security challenges. Effective community integration requires moving beyond the provision of employment toward substantive benefit-sharing and value-chain participation. Backward linkages—sourcing inputs, equipment, and services from local providers—can generate community income while potentially reducing plantation costs. Forward linkages—community involvement in processing, transportation, and marketing—enable communities to capture additional value from the value chain [38,69].

However, implementation of such linkages remains limited, with most plantations maintaining self-contained operations or relationships with distant suppliers. Barriers include community enterprises' limited capacity to meet plantation-quality and reliability requirements, a lack of capital to establish processing facilities, and plantation management's preference for familiar external partners. Overcoming these barriers requires capacity building for community enterprises, financing mechanisms for community-based ventures, and incentive frameworks (regulatory requirements or certification standards) encouraging plantation-community partnerships [11,70].

Multifunctional land-use approaches, including intercropping and livestock integration, offer additional opportunities for community integration. Studies document the economic viability of these approaches: intercropping generates $500-1,200/ha annually during immature phases, and livestock integration provides $300-800/ha while reducing weeding costs. Allowing community participation in these activities on plantation lands could provide livelihood benefits while strengthening relationships. However, operationalizing such arrangements requires clear agreements that specify rights and responsibilities, monitoring mechanisms to ensure compliance with plantation management requirements, and benefit-sharing formulas acceptable to both parties [1,38,71,72].

Evidence regarding the impacts of community integration on plantation security and performance remains limited but suggestive. Studies indicate that plantations with stronger community relationships and substantive benefit-sharing experience fewer conflicts, lower security costs, and better community cooperation in preventing theft and damage. However, causality remains unclear—successful plantations may be both more profitable (enabling greater community investment) and better managed (including community relations). Nonetheless, the correlation suggests that viewing community integration as a costly obligation rather than a strategic investment may be short-sighted [4].

Theme 6: Certification, Standards, and Smallholder Inclusion

Sustainability certification schemes (RSPO, ISPO) increasingly condition market access on documented land tenure legality, environmental compliance, and social standards. However, participation in smallholder certification remains limited, with estimates suggesting that only 15-25% of Indonesian independent smallholders hold any certification. Barriers include: land tenure documentation requirements (many smallholders lack formal certificates); complex documentation and record-keeping obligations; certification costs ($200-500/smallholder for ISPO, higher for RSPO); limited technical capacity for compliance; and insufficient price premiums to offset costs [7,11,73].

Group certification approaches attempt to address these barriers by enabling smallholders to certify collectively, sharing costs and technical support. Evidence suggests group certification

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can substantially reduce per-farmer costs and documentation burdens when coordinated through effective cooperatives or farmer organizations. However, group certification requires strong organizational capacity for internal monitoring, ensuring member compliance, and maintaining documentation—capacities often lacking in Indonesian smallholder organizations [11,28].

Streamlining certification processes for smallholders emerges as a critical policy priority. ISPO's recent revisions simplifying smallholder requirements represent progress, though implementation challenges remain. Further measures could include: government support for land tenure documentation enabling certification eligibility; subsidies covering initial certification costs; simplified compliance requirements for small producers; stronger price premiums for certified oil rewarding compliance investments; and technical support programs building smallholder capacity for meeting standards [7,11,74,75].

Certification's equity implications are ambiguous. By conditioning market access on compliance with standards that disadvantage smallholders, certification could exclude vulnerable producers, exacerbating inequality. Alternatively, by establishing clear pathways for smallholder improvement and potentially commanding price premiums, certification could enable smallholder advancement. Outcomes depend critically on implementation—whether certification systems adapt their requirements and support mechanisms to smallholder realities or impose uniform standards that favor large producers [11,76].

Discussion and Analysis

Synthesizing Findings: Conditions for Equity-Productivity Synergy

Evidence synthesis reveals that achieving equity-productivity synergy requires four mutually reinforcing conditions. First, secure land tenure provides the foundation for long-term investment and sustainable management. Without documented rights, farmers remain ineligible for credit, vulnerable to displacement, and rationally prioritize short-term extraction over productivity-enhancing investments. Agrarian reforms emphasizing redistribution without securing tenure for beneficiaries thus risk failing on both equity (insecure beneficiaries) and productivity (underinvestment) dimensions [2,7,14,18].

Second, institutional support mechanisms—particularly effective cooperatives—enable smallholders to capture economies of scale while retaining the advantages of family farms. Cooperatives provide integrated services addressing smallholders' multiple constraints: input access through bulk purchasing; technical knowledge through extension programs; credit access through group guarantees; and market access through collective marketing. Without such institutional infrastructure, smallholder productivity remains constrained regardless of land access [36,37].

Third, access to technology and knowledge transfer are essential for productivity convergence between smallholders and estates. Yield gap analysis demonstrates that smallholder underperformance reflects knowledge and input gaps rather than intrinsic management limitations. Intensive extension services, demonstration plots, farmer field schools, and peer learning mechanisms can effectively transfer best practices, enabling smallholder productivity to approach estate levels. However, current extension systems rarely provide the intensity and quality of support required [17,58].

Fourth, inclusive value chain integration ensures smallholders receive fair prices and access to markets. Monopsony power of mills and traders often captures large shares of value, leaving smallholders with insufficient returns to finance productivity-enhancing investments. Cooperative marketing, direct contracts with processors, and vertical integration into processing enable smallholders to capture additional value along the value chain. Certification that provides market access to premium sustainability markets offers additional opportunities for smallholders who meet the standards [7,11,22,23].

These four conditions—tenure security, institutional support, technology access, and value chain integration—constitute an interdependent system rather than independent factors. Tenure security enables credit access and long-term investment, which increases returns, justifies cooperative membership fees, and enables cooperatives to provide quality services that facilitate technology adoption and certification compliance, improve product quality, enable access to premium markets, and increase incomes, thereby supporting further investment. Conversely, gaps in any component undermine the entire system, which explains why partial interventions often fail to achieve transformative impact [11,14,18].

Agrarian Reform Implementation Strategies

Successful agrarian reform in plantation sectors requires comprehensive, sequenced approaches rather than simple land redistribution. The Malaysian FELDA experience demonstrates that state-led smallholder development can succeed when backed by adequate resources, technical capacity, and sustained commitment. Key FELDA elements applicable to Indonesian contexts include: large-scale land acquisition and development before allocation, ensuring beneficiaries receive productive plantations rather than raw land; intensive support services including inputs, credit, extension, and marketing during establishment and early operational phases; centralized processing facilities ensuring economies of scale and quality control; and phased transition from state management to farmer control aligned with capacity development [2,34,41].

However, FELDA's substantial costs—estimated at $20,000- $ 30,000 per beneficiary household for full development—exceed the fiscal capacity of most developing countries, including

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Indonesia. More fiscally constrained approaches must therefore emphasize institutional development over state-led physical development. Cooperative-strengthening programs that build organizational capacity for service provision, technology platforms that enable extension and market linkage at lower cost, and public-private partnerships that leverage corporate resources for smallholder support offer more scalable alternatives [41,68].

HGU reform constitutes a critical component of agrarian reform strategy. Transforming HGU from quasi-ownership to authentic leasehold with rigorous performance accountability would serve multiple objectives. For efficiency, conditional renewal incentivizes productivity, environmental compliance, and continuous improvement, while enabling the redistribution of underutilized land, thereby enhancing aggregate productivity by reallocating resources to more motivated users. For equity, systematic evaluation and potential non-renewal create opportunities to redistribute land to smallholders without requiring compensated expropriation, while community benefit requirements as renewal conditions ensure that plantations contribute to local welfare [1,2,6].

Operationalizing HGU reform requires several elements: objective evaluation frameworks assessing productivity (yield per hectare), environmental compliance (deforestation, biodiversity, emissions), labor standards (wages, working conditions, safety), and community contributions (employment, infrastructure, benefit-sharing); transparent, participatory evaluation processes incorporating community input and independent verification; clear performance thresholds triggering consequences including conditional renewal, required corrective action plans, or non-renewal; and Land Bank capacity for managing transition of expired or revoked HGU including temporary management and redistribution to qualified beneficiaries [20].

Nucleus-plasma ratio transformation toward greater plasma shares requires carefully managed transitions. Immediate wholesale restructuring risks disrupting productivity due to inadequate preparation. More prudent approaches involve: pilot projects testing 20:80 models in selected locations, enabling learning and adaptation before scaling; phased conversion of existing schemes with timeline milestones (e.g., achieving 30% plasma by year 5, 50% by year 10, 70% by year 15); intensive cooperative capacity building preceding and accompanying conversion, ensuring institutional readiness; regulatory frameworks requiring minimum plasma percentages for new HGU and renewals, gradually increasing requirements over time; and performance monitoring with adaptive management, adjusting timelines and approaches based on emerging evidence [40].

Community Integration and Multifunctional Approaches

Effective community integration strategies extend beyond the provision of employment to substantive value chain participation and benefit sharing. Backward linkage development—sourcing inputs, services, and equipment from community enterprises—requires capacity-building support to enable local providers to meet plantation quality and reliability requirements. Forward linkage development—community involvement in processing, transportation, and value addition—requires access to capital for establishing enterprises and technical assistance to achieve operational viability [38,77].

Benefit-sharing mechanisms could formalize plantation contributions to community welfare. Models include: percentage of HGU area (e.g., 5-10%) allocated for community use including intercropping or livestock integration; revenue-sharing arrangements allocating percentage of plantation profits to community development funds; preferential employment and procurement policies favoring local community members and enterprises; infrastructure development obligations including roads, schools, and health facilities benefiting broader community; and collaborative land-use planning integrating plantation development with community spatial plans [30,47].

Multifunctional land-use approaches integrating food crops, livestock, and perennial plantations offer promising pathways to enhance both productivity and equity. Intercropping during immature phases generates income in non-productive years and provides agronomic benefits, with economic returns of $500- $1,200/ha that justify adoption. Livestock integration with undergrowth vegetation generates income of $300-800/ha while reducing weeding costs by 40-60%, creating a win-win outcome. However, realizing these potentials requires research to establish optimal management practices to prevent negative impacts on palm productivity; extension services to transfer knowledge to farmers and plantation managers; and regulatory frameworks to clarify rights and responsibilities when integrating activities on plantation lands [49,52].

Institutional Development and Capacity Building

The centrality of institutional capacity for agrarian reform success demands sustained investment in cooperative development, farmer organization strengthening, and extension system transformation. Cooperative capacity building must address multiple dimensions: governance systems establishing transparency, accountability, and member participation; financial management including accounting, auditing, and working capital management; technical capacity for agronomic advice, quality control, and certification compliance; business management including strategic planning, procurement, marketing, and partnership negotiation; and member education building understanding of cooperative principles, rights, and responsibilities [2,11,30,38,78].

Effective capacity building requires long-term engagement (5-10 years) rather than short-term training workshops. Successful models include: embedded technical advisors working within

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cooperatives over multi-year periods; peer learning networks connecting cooperatives for knowledge exchange; matching-grant programs supporting institutional development investments; and regulatory frameworks that require cooperatives to maintain professional management and conduct regular audits while preventing excessive government interference [68].

Extension system transformation toward more intensive, responsive smallholder support proves equally critical. Current public extension systems, characterized by inadequate staffing, limited field presence, and top-down knowledge-transfer approaches, are insufficient to close yield gaps. Innovations include: farmer field schools that emphasize experiential learning and peer-to-peer knowledge transfer; digital extension platforms that use mobile technology to deliver personalized advice at scale; private extension services provided by input suppliers, processors, or specialized firms; and science-technology backyard models that embed university researchers in rural communities for intensive, long-term support [56,58].

Conclusion

Substantive Conclusions

This comprehensive literature review establishes that balancing equity and productivity in oil palm plantation land governance constitutes a challenging but achievable objective. Smallholders, when provided with secure tenure, institutional support, access to technology, and market linkages, can achieve productivity levels that match those of large corporate estates, thereby substantially reducing the equity-productivity trade-off through appropriate policy design. However, realizing this potential requires comprehensive reform strategies that address land tenure security, institutional capacity building, extension services, value chain integration, and regulatory frameworks, implemented through phased transitions that minimize disruption while building necessary capacity.

HGU system reform, transforming leasehold principles from nominal to operational, would serve both efficiency and equity objectives by incentivizing productivity, enabling redistribution of underperforming lands, and creating mechanisms for smooth transitions at expiry rather than conflicts and abandonment. Land Bank institutions, when adequately capacitated, can facilitate these transitions by temporarily managing expired HGUs until they are redistributed to qualified beneficiaries organized into cooperatives.

Nucleus-plasma partnership transformation toward greater smallholder shares is feasible but requires careful sequencing, with intensive cooperative capacity building that precedes and accompanies structural changes. International experiences, particularly Malaysia's FELDA, demonstrate that state-supported smallholder plantation development can achieve high productivity and significant poverty reduction, though substantial public investment and long-term commitment prove essential.

Community integration through backward-forward linkages, benefit-sharing mechanisms, and multifunctional land use approaches can enhance both social equity and plantation security while maintaining or improving productivity. However, operationalizing these approaches requires overcoming implementation barriers through capacity building, appropriate regulations, and a changed corporate mindset that views community investment as strategic rather than obligatory.

Policy Recommendations

Based on evidence synthesis, this study proposes comprehensive policy recommendations organized into six strategic domains:

i. HGU System Reform and Enforcement

Immediate priorities (1-3 years) include comprehensive HGU audits assessing current holdings against legal limits, productivity performance, environmental compliance, and social contributions; establishing operational evaluation frameworks with clear criteria, transparent processes, and participatory mechanisms; and strengthening the Land Bank's institutional capacity with adequate staffing, technical capacity, and financing. Medium-term measures (3-7 years) should implement conditional HGU renewal with non-renewal consequences for chronic underperformance, smooth transition mechanisms for expired or revoked HGU, and large-scale land tenure documentation for existing smallholders. Long-term objectives (7-15 years) target full enforcement of HGU leasehold principles with automatic expiry upon non-renewal, achieving 30% of plantation area under smallholder management, and sustainable ownership structures that balance corporate and smallholder participation.

ii. Nucleus-Plasma Partnership Transformation

Develop a phased roadmap to transform selected nucleus-plasma schemes from 80:20 to 20:80 ratios over 10-15 years through pilot testing, intensive monitoring, and adaptive management. Establish regulatory frameworks that require minimum plasma percentages for new HGU and renewal applications, gradually increasing these requirements over time. Prioritize cooperative capacity-building through long-term technical assistance, matching grants for institutional development, and peer-learning networks. Provide fiscal incentives for companies developing high-quality plasma schemes while imposing penalties for poor plasma management.

iii. Smallholder Productivity Enhancement

Establish regional palm oil extension centers providing intensive, responsive technical support through embedded advisors, farmer field schools, and demonstration plots. Implement targeted credit programs for smallholder replanting, intensification, and certification, with appropriate risk-mitigation

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mechanisms. Accelerate land tenure documentation, enabling smallholder access to credit and certification programs. Develop digital extension platforms that provide personalized advice at scale via mobile technology. Support the formation and strengthening of farmer groups as entry points for services and pathways to cooperative development.

iv. Certification and Market Access

Streamline ISPO certification for smallholders through simplified requirements, government support for documentation, and subsidized initial certification costs. Promote group certification approaches that share costs and technical support through cooperatives. Strengthen price premiums for certified sustainable palm oil to reward investments in compliance and incentivize adoption. Facilitate cooperative marketing arrangements to improve smallholder bargaining power and value capture.

v. Community Integration and Benefit Sharing

Mandate community benefit-sharing requirements as HGU renewal conditions, including employment preferences, local procurement, infrastructure contributions, and revenue sharing. Formalize community participation in multifunctional land use, including intercropping during immature phases and livestock integration in mature plantations, through clear agreements and monitoring mechanisms. Promote backward-forward linkages through capacity-building for community enterprises and preferential procurement policies. Establish participatory land-use planning processes integrating plantation development with community spatial plans and customary tenure systems.

vi. Institutional Development and Governance

Implement comprehensive cooperative capacity-building programs that address governance, financial management, technical skills, and member education over 5-10-year timeframes. Establish regulatory frameworks that promote cooperative accountability through required audits and financial transparency, while preventing excessive government interference. Develop multi-stakeholder platforms facilitating government-corporate-community collaboration in plantation landscape governance. Create monitoring and evaluation systems to track equity and productivity indicators, with transparent public reporting and adaptive policy adjustments.

Implementation Roadmap

Phase 1: Foundation Building (Years 1-3)

Complete comprehensive HGU audits establishing baseline data; establish and operationalize Land Bank with adequate capacity; launch pilot projects for 20:80 nucleus-plasma transformation in selected locations; initiate large-scale cooperative capacity building programs; streamline ISPO certification and begin smallholder certification drives.

Phase 2: Scaling Up (Years 4-7)

Implement conditional HGU renewal with performance-based decisions; expand successful pilot models to additional regions; achieve 50% independent smallholder organizations in functioning groups or cooperatives; reach 50% smallholder ISPO certification; strengthen backward-forward linkages in plantation landscapes.

Phase 3: Institutionalization (Years 8-15)

Achieve full enforcement of reformed HGU system with automatic expiry and smooth transitions; complete transformation toward 20:80 ratios in pilot regions and expand to broader implementation; reach 30% plantation area under smallholder management with productivity matching corporate averages; establish self-sustaining institutional ecosystem requiring minimal ongoing government support; embed equity-productivity balance as normal rather than exceptional practice.

Concluding Remarks

Achieving a sustainable balance between equity and productivity in oil palm plantation land governance represents one of Indonesia's most significant contemporary policy challenges. The stakes extend beyond sectoral performance to encompass rural welfare, social stability, environmental sustainability, and national development pathways. This review demonstrates that the challenge, while substantial, is surmountable through evidence-based, comprehensive reform strategies.

The fundamental insight emerging from the literature synthesis is that equity and productivity need not be antagonistic objectives that require painful trade-offs. Rather, when appropriate institutional conditions exist—secure tenure, effective cooperatives, access to technology, and market integration—smallholder cultivation can match or exceed corporate productivity while generating more equitable distribution of benefits. The policy imperative thus shifts from accepting inevitable equity-productivity trade-offs to creating conditions enabling their synergistic realization.

However, achieving this transformation demands sustained commitment, substantial investment, and patient implementation over decade-plus timeframes. Quick fixes—whether immediate large-scale land redistribution or the maintenance of the status quo of corporate dominance—will fail. Success requires building institutional capacity, particularly cooperative strengthening; securing smallholder tenure; transforming extension systems; reforming HGU governance; and facilitating inclusive value chains. These elements form an integrated system in which progress in each dimension reinforces the others, creating virtuous cycles of improvement.

Indonesia's oil palm sector, despite current challenges, possesses substantial latent potential for more equitable, productive, and sustainable configurations. Realizing this

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potential requires political will, institutional innovation, and evidence-based policy design. This review provides conceptual frameworks, empirical evidence, and policy roadmaps to guide that transformation. The opportunity exists to demonstrate that plantation agriculture can serve broad-based development, refuting assumptions that productivity requires inequality. Seizing this opportunity would generate benefits that extend far beyond Indonesia's palm oil sector, influencing global debates about agriculture, development, and sustainability.

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