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Assessing collaborative governance and socio-economic outcomes of Forest Program III in Lore Lindu Landscape, Indonesia

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Abstract. *Massiri SD, Golar, Muis H, Naharuddin, Malik A, Pribadi H, Hamzari, Misrah. 2026. Assessing collaborative governance and socio-economic outcomes of Forest Program III in Lore Lindu Landscape, Indonesia. Asian J For 10 (1): r100107. https://doi.org/10.13057/asianjfor/r100107.* Addressing tropical deforestation in high biodiversity regions such as Indonesia requires governance approaches that balance conservation goals with livelihood needs. This study examines the outcomes of the Forest Program III (FP III), a German-Indonesian initiative (2017-2024), in implementing collaborative forest governance in the Lore Lindu landscape of Central Sulawesi. The research aimed to assess governance effectiveness, socio-economic impacts, and institutional dynamics under the FP III. A mixed-methods research design was applied, combining structured surveys with 940 respondents from 48 villages, in-depth stakeholder interviews, and focus group discussions. The results indicate that the FP III improved multi-stakeholder participation, promoted sustainable land-use practices, and strengthened conservation outcomes. However, the contribution of forest-based activities to household income averaged only 28.23%, demonstrating that ecological gains were not matched by significant livelihood benefits. Elite capture further constrained equitable participation, while central agencies retained dominant facilitation roles that limited the capacity of local Forest Management Units (FMUs) to act as bridging institutions. The findings suggest that collaborative governance can deliver ecological benefits, but integrated livelihood interventions and stronger polycentric governance are essential to sustain outcomes. Clearer institutional arrangements between central and regional agencies, empowerment of FMUs, and market facilitation for community enterprises are critical to scaling collaborative forest governance in Indonesia's biodiverse landscapes.

Keywords: Economic empowerment, Forest Management Units, participatory governance, social forestry, Sulawesi

INTRODUCTION

Land-use change, deforestation and forest degradation remain pressing global challenges with far-reaching implications for climate stability, biodiversity conservation, and human well-being (MacKinnon et al. 2020; Winkler et al. 2021). Tropical forests provide essential ecosystem services such as carbon storage, watershed regulation, and habitat protection, yet these resources are increasingly threatened by agricultural expansion, logging, and land conversion. Addressing these intertwined ecological and socio-economic problems requires governance approaches that transcend sectoral boundaries. This involves engaging diverse stakeholders in the collective stewardship of forest landscapes (Watson et al. 2018; Debie and Singh 2021). Forests are classic common-pool resources that provide global public goods but ultimately depend on inclusive local governance for long-term sustainability (Ostrom 1990; Eriksson et al. 2018).

Collaborative governance has been widely promoted as a strategy to address these complex forest management dynamics. It is defined as a consensus-oriented arrangement where public institutions and non-state actors share authority in joint decision-making (Ansell and Gash 2008), emphasizing trust-building and principled engagement (Emerson et al. 2012). In forestry, this often materializes through co-management, where communities, governments, and civil society jointly manage resources (Carlsson and Berkes 2005; Kusters et al. 2020). These arrangements align with Ostrom's design principles, which highlight clear boundaries, participatory rules, accountability, and nested governance as essential conditions for effectiveness (Ostrom 1990, 2010).

Recent empirical evidence demonstrates that inclusive governance can generate ecological benefits while supporting rural livelihoods (Fischer et al. 2023). However, outcomes remain highly variable. While some initiatives enhance conservation, others reveal that formal participation does not automatically guarantee equity. Factors such as elite capture, power asymmetries, and weak institutional capacity frequently limit success (Larson and Ribot 2007; Agrawal et al. 2008; Swette et al. 2023). Success depends on how institutional design interacts with local socio-political contexts (Arai et al. 2021; Charmakar et al. 2024).

Experiences across Southeast Asia further illustrate these complex dynamics. increased participation but struggled with income generation due to weak market linkages (Reed et al. 2020). In Laos, REDD+ consultations often reproduced power asymmetries, reducing community trust (Sawathvong et al. 2024). Similarly, Thailand's collaborative approaches improved ecological outcomes but provided modest livelihood benefits (Roengtam and

Agustiyara 2022). Collectively, these cases suggest that governance innovations may strengthen ecological integrity yet often fail to deliver equitable socio-economic outcomes, necessitating a focus on measurable livelihood impacts.

Indonesia provides a particularly relevant context for this investigation. Despite its immense biodiversity, the country faces persistent deforestation that undermines both ecosystems and rural welfare (Nuñez et al. 2019). In response, the government has advanced social forestry and Forest Management Units (KPHs) as central instruments to reconcile conservation with livelihood improvement (Perpres No. 88/2017; Permen LHK No. 9/2021). Social forestry provides legal access for communities, while FMUs bridge national policies with local implementation. However, contributions to household income remain uneven, constrained by market limitations and weak organizational capacity (Galudra 2019; Massiri et al. 2020).

Within this landscape, the Forest Program III (FP III), implemented (2017-2024) through German–Indonesian cooperation, offers a valuable case study. Conducted in the Lore Lindu Landscape, a UNESCO Biosphere Reserve, the program integrated conservation, watershed rehabilitation, and livelihood development across 48 villages (Golar et al. 2022). Despite these interventions, Lore Lindu continues to face pressures from illegal logging and climate stress (Khaeruddin 2019). These challenges make Lore Lindu emblematic of governance struggles in biodiversity-rich regions where ecological value intersects with poverty.

Systematic evidence on whether initiatives like FP III produce tangible socio-economic outcomes remains limited. Many studies in Indonesia emphasize institutional processes without evaluating measurable livelihood improvements (Santika et al. 2019; Begum et al. 2021; Tando et al. 2022). Furthermore, the role of FMUs as decentralized facilitators is often overshadowed by central technical agencies (Tajuddin et al. 2019).

This study addresses these gaps by evaluating FP III's outcomes in Lore Lindu. Specifically, it examines: (i) multi-stakeholder collaboration, (ii) community-based management practices, and (iii) socio-economic impacts on households. By situating this case within broader polycentric governance debates, the study provides empirical evidence on how governance design influences outcomes and offers policy recommendations for sustainable forest management in the Global South.

MATERIALS AND METHODS

Study area

The Lore Lindu Landscape represents a complex socio-ecological system characterized by overlapping forest functions and a high degree of institutional complexity in Indonesia (Figure 1). The landscape encompasses the Lore Lindu National Park (LLNP) as the core conservation zone, covering approximately 217,991 hectares, along with surrounding protection forests (*Hutan Lindung*) and other land-use areas (*Area Penggunaan Lain*/APL) located within the administrative boundaries of Poso and Sigi Districts, Central Sulawesi Province. The landscape of LLNP is predominantly composed of secondary dryland forest (80.6%) and primary dryland forest (10.16%), while the remaining area is utilized for community plantations and settlements (Suni et al. 2025).

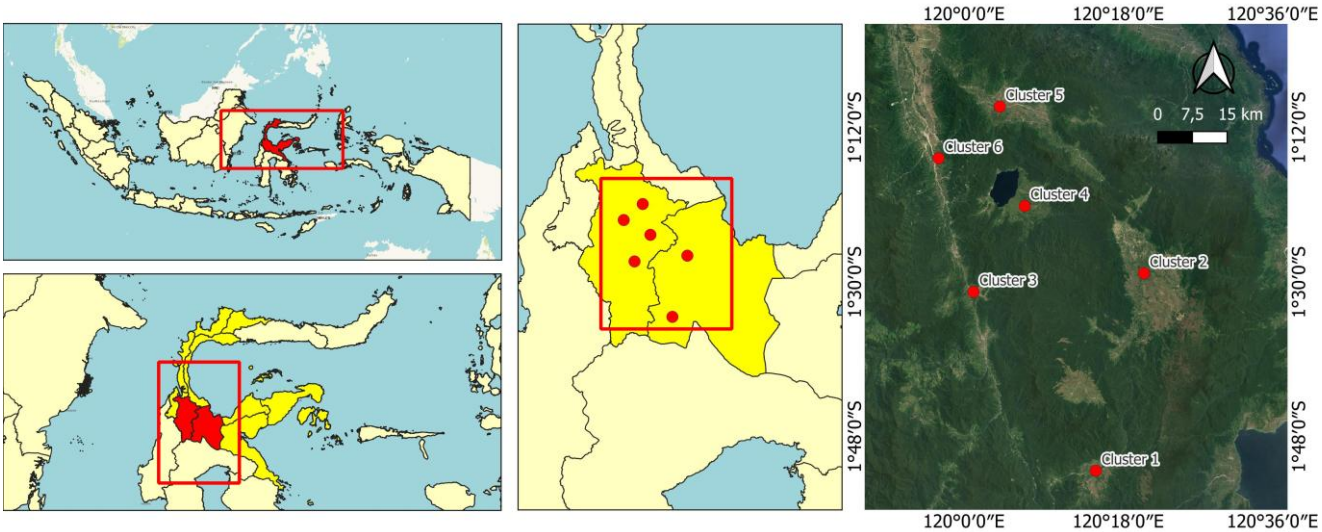


Figure 1. Research location in Lore Lindu Landscape, Central Sulawesi Province, Indonesia. Cluster1 (1°51'57.98"S, 120°15'23.02"E), Cluster 2 (1°28'57.79"S, 120°21'0.69"E), Cluster 3 (1°31'7.90"S, 120°1'7.43"E), Cluster 4 (1°21'7.23"S, 120°7'6.28"E), Cluster 5 (1°9'32.25"S, 120°4'12.52"E), Cluster 6 (1°15'33.53"S, 119°57'3.40"E)

This study specifically focused on 48 villages prioritized under the Forest Programme III (FP III), a bilateral cooperation initiative between the Governments of Indonesia and Germany (2017-2024), funded by KfW/BMZ. The primary objective of FP III was to balance biodiversity conservation within the national park with sustainable livelihood development and watershed rehabilitation in the surrounding landscape. For analytical purposes, the project implementers grouped the villages into six clusters based on ethnic composition, landscape characteristics, and administrative boundaries. Cluster 1 (6 villages in Lore Barat Sub-district, Poso District) lies approximately 370 km from Palu, the provincial capital and is predominantly inhabited by the Bada ethnic group. Cluster 2 (10 villages in Lore Utara and Lore Peore Sub-districts, Poso District), approximately 120 km from Palu, is is mainly inhabited by the Pekurehua ethnic group together with Bugis and Javanese migrants. Cluster 3 (7 villages in Kulawi and South Kulawi Sub-districts, Sigi District), approximately 80 km away, is predominantly inhabited by Kaili and Uma ethnic groups along with Bugis settlers, while Cluster 4 (10 villages in Lindu and part of Kulawi Sub-districts, Sigi District) lies at a similar distance but has poor accessibility and is predominantly inhabited by the Lindu ethnic group. Cluster 5 (10 villages in Palolo Valley, Sigi District), approximately 60 km from the capital, has relatively easy access and a heterogeneous population (Kaili, Javanese, Bugis). Cluster 6 (5 villages in South Dolo Sub-districts, Sigi District), the closest cluster at approximately 30 km, is predominantly inhabited by the Kaili ethnic group. The spatial distribution of these research locations is presented in Figure 1.

Research design

This study employed a mixed methodological approach: (i) an empirical approach to identify facts related to the program's benefits and impacts, and (ii) an evaluative approach to interpret the significance and value of these findings, guided by participatory principles. The study framework began with respondent selection, focusing on institutions and beneficiaries of FP III activities. Beneficiaries were categorized into direct and indirect recipients. Six groups were identified as direct beneficiaries: Community Forestry Groups (*Hutan Kemasyarakatan/HKm*), Village Forest Management Groups (*Hutan Desa/HD*), Village-Based Conservation Management Institutions (*Lembaga Pengelola Konservasi Desa/LPKD)*, agroforestry groups, small business enterprises, and women's empowerment groups

This study evaluated governance within the FP III project, using the aspect of strengthening stakeholder roles in Lore Lindu Landscape governance as an entry point. Operationalization was achieved through five criteria: stakeholder roles, commitment, involvement, program implementation, and institutional capacity. To align these with adapted governance evaluation frameworks in forest governance (Lockwood et al. 2010; Emerson et al. 2012), these criteria were mapped onto the dimensions of participation, legitimacy, equity, institutional arrangements, integration, capacity and accountability. In this research, participation, legitimacy, equity and integration are reflected through an analysis of stakeholder roles, involvement, and commitment, emphasising the inclusivity of community groups, women's groups, and local institutions in decision-making and benefit distribution processes. Institutional arrangements and capacity were assessed by evaluating the functions and readiness of local institutions to support collaborative management. Accountability is reflected in programme implementation, with compliance with collaboratively developed plans and regulations being assessed.

Furthermore, this analytical framework was complemented by Ostrom's (1990) design principles for collective governance, particularly participation, accountability, and equitable benefit-sharing, which provide a theoretical lens for assessing institutional robustness. In addition, the collaborative governance model of Ansell and Gash (2008) was referenced to interpret the dynamics of multi-stakeholder interactions, trust-building, and shared responsibility in the FP III program.

The evaluation framework used to assess the impact of the FP III project, as illustrated in Figure 2, consists of three aspects described through criteria and indicators. Each component is operationalized through specific criteria, with appropriate indicators and verification measures established for assessment. The evaluation indicators employ quantitative, tiered data measurements to enable statistical analysis, ensuring robust examination of program outcomes.

Sampling design and respondent selection

This study adopts an ex-post program evaluation design to examine governance dynamics and socio-economic outcomes among participants of Forest Program III (FP III) across the Lore Lindu Landscape. A multi-stage stratified purposive sampling strategy was employed to capture program-specific perspectives across the 48 villages involved in FP III. The sampling frame intentionally focused on FP III beneficiaries and institutional actors facilitated under the program, including Village-Based Conservation Management Institutions (*LPKD)*, agroforestry groups, social forestry organizations, and women's groups. Within each FP III-facilitated institution, ten respondents were selected, consisting of three administrators, five general members, ensuring gender and age representation, and two local leaders associated with the group's activities. As most villages hosted multiple active FP III-supported groups (averaging two to three groups per village), this approach resulted in a cumulative sample of 940 respondents across the 48 study villages. This clarification reconciles the reported sample size and reflects the institutional diversity of FP III implementation across clusters. Because the sampling strategy deliberately prioritizes program beneficiaries and institutional actors, the findings are not intended to be representative of the broader village population. Rather, they are designed to capture program-specific dynamics and internal heterogeneity relevant to evaluating FP III as an ex-post intervention.

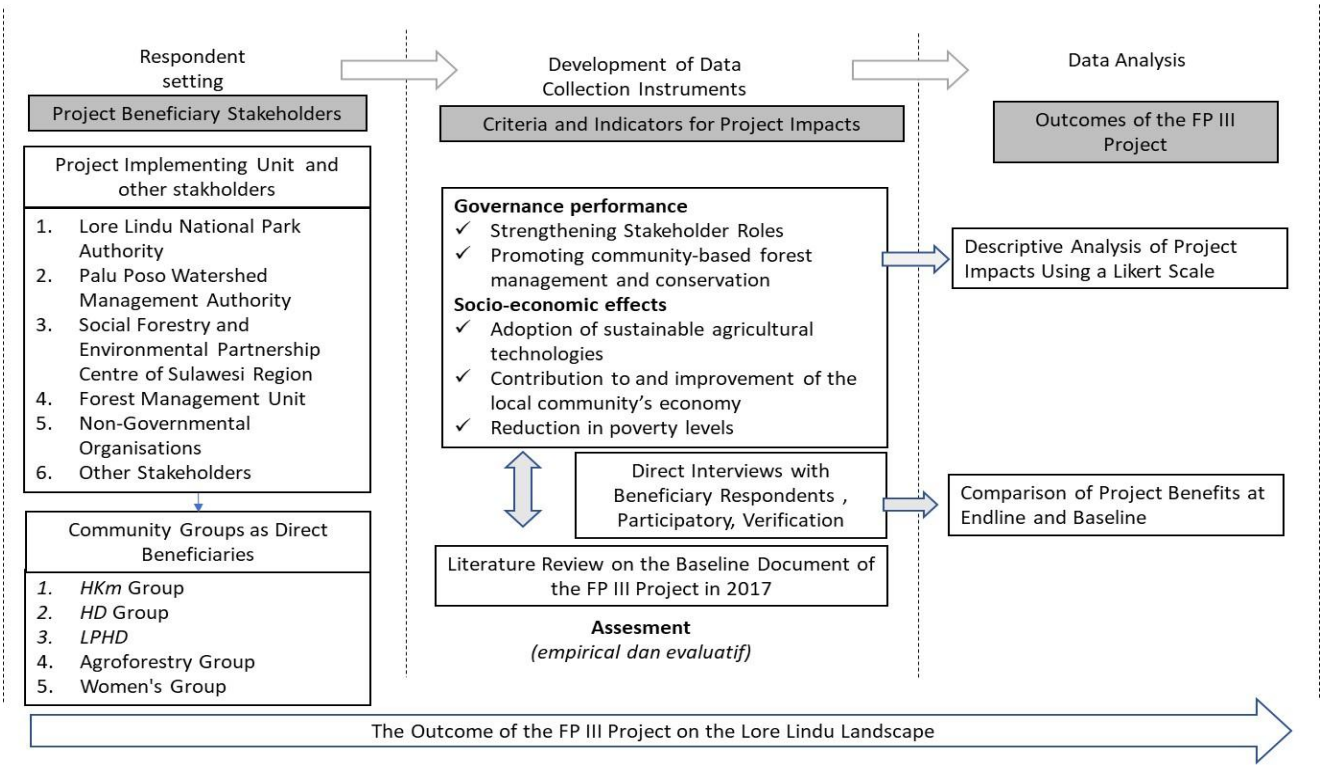


Figure 2. Assessment framework

Data collection

Data collection was conducted over a five-month period, from February to June 2024. A mixed-method approach was employed to capture both quantitative and qualitative dimensions of collaborative governance and socio-economic outcomes under FP III. Primary data collection consisted of two components. First, structured questionnaire-based interviews were administered to the

To ensure representation of different perspectives, stakeholders were grouped into four main categories: (i) community-based organizations (e.g., agroforestry groups, land rehabilitation groups, Village-Based Conservation Management Institutions (*Lembaga Pengelola Konservasi Desa/LPKD*), social forestry organizations, and women's groups), (ii) village governments, (iii) state authorities including Lore Lindu National Park Authority (*Balai Besar Taman Nasional Lore Lindu/BBTNLL*), Palu Poso Watershed Management Authority (*Balai Pengelolaan Daerah Aliran Sungai Palu Poso/BPDAS Palu Poso)*, Social Forestry and Environmental Partnership Center of Sulawesi Region (*Balai Perhutanan Sosial dan Kemitraan Lingkungan/BPSKL Wilayah Sulawesi*), and regional Forest Management Units (FMUs), and (iv) supporting institutions (e.g., a consortium of NGOs and a consortium of universities)

Several safeguards were implemented to enhance measurement validity and mitigate potential social-desirability and enumerator biases. Enumerators received training in neutral probing techniques and standardized interview procedures. Respondent anonymity was strictly maintained, and participants were informed that their

940 FP III beneficiaries to quantify governance performance and socio-economic outcomes, including stakeholder participation, institutional capacity, livelihood activities, and income dynamics. Second, in-depth interviews were conducted with selected key informants to document implementation processes, coordination among institutions, and contextual challenges influencing program outcomes.

responses would not affect current or future program participation.

Following completion of the surveys, cluster-based Focus Group Discussions (FGDs) were conducted across the six geographic clusters as a participatory validation mechanism. These FGDs were used to cross-check aggregate quantitative findings—particularly Likert-scale governance scores—against qualitative field realities, to identify discrepancies between reported responses and observed institutional practices, and to contextualize variations across clusters. This triangulation strengthened the contextual validity of the findings and reduced the risk of courtesy or compliance bias.

Data analysis

The governance performance of Lore Lindu Landscape was initially examined through qualitative analysis and subsequently reinforced using composite evaluative indicators measured with 5-point Likert scales. To mitigate potential response biases inherent in Likert-scale data, such as central tendency, agreement, and social-desirability biases, the study implemented several safeguards, including enumerator training in neutral probing techniques, strict respondent anonymity, and systematic triangulation with

qualitative evidence from in-depth interviews and focus group discussions.

The Likert-scale responses, while ordinal by nature, were treated as quasi-interval data to facilitate descriptive comparison across clusters, a common practice in evaluative governance studies. The analysis emphasizes relative patterns and internal heterogeneity rather than precise metric differences or causal attribution.

Socio-economic outcomes, including knowledge adoption, livelihood activities, and household income (π=TR−TC), were analyzed using descriptive statistics. Poverty dynamics were assessed using the Poverty Probability Index (PPI), with baseline–endline comparisons were used descriptively at the cluster level to illustrate indicative trends rather than causal effects. Baseline–endline comparisons of PPI scores and household income were conducted at the cluster level to illustrate indicative changes over the program period. These comparisons are used descriptively to explore internal variation among FP III beneficiaries and do not imply causal attribution.

Ethical considerations

Prior to data collection, all participants were informed about the objectives of the research, the voluntary nature of participation, and the confidentiality of their responses. Informed verbal consent was obtained before each interview and household survey. To ensure fairness and inclusiveness, community representation was achieved by engaging village governments, social forestry groups, women's organizations, and other local institutions across the 48 participating villages. All procedures followed standard ethical practices for social research and participatory forest governance assessments. The indicators, data sources, and analytical approaches used in this study are summarized in Table 1.

RESULTS AND DISCUSSION

Transparency and accountability in governance

The Forest Program III (FP III) introduced a multi-tier governance framework that engaged central, regional, and community-based actors in the Lore Lindu Landscape. Yet, the distribution of authority proved uneven. Central government technical units under the auspice of the Ministry of Forestry—particularly *BBTNLL*, *BPDAS Palu Poso*, and *BPSKL* Sulawesi—dominated project facilitation, while regional Forest Management Units (FMUs) played only a marginal role. This imbalance created a transparency gap, as decision-making remained concentrated at higher levels and was less open to local scrutiny. The differentiated roles and levels of engagement of external, secondary, and primary stakeholders are presented in Table 2, which clearly shows the dominant roles of central technical agencies compared to the limited involvement of FMUs.

From an accountability perspective, central agencies were effective in facilitating conservation partnerships, social forestry groups, and land rehabilitation activities. However, their dominance constrained the intended devolution of authority to FMUs, especially in non-park areas where FMUs hold a legal mandate to function as bridging institutions between national policy and community practice. Within the Lore Lindu National Park, by contrast, governance authority legitimately rests with *BBTNLL*, explaining why FMUs appear less visible across the landscape. The overall governance structure of FP III is illustrated in Figure 3, highlighting how central technical units occupy the core facilitative position, while FMUs remain at the periphery of implementation.

These findings suggest that FP III governance arrangements only partially achieved the accountability envisioned under Indonesia's decentralization framework. The persistence of centralized facilitation reflects what Ostrom (2010) and Andersson and Ostrom (2008) describe as the risks of "incomplete decentralization," where formal mandates exist but institutional power remains concentrated at higher levels. Strengthening coordination between *BBTNLL* and FMUs, with clearer role division across national park and non-park areas, is therefore critical to ensure transparency, enhance downward accountability, and move toward a more polycentric governance system in the Lore Lindu Landscape.

Participation and inclusiveness

FP III encouraged the formation of diverse community groups to promote inclusive participation in collaborative governance. As indicated in Table 3, a wide range of local organizations, including village conservation institutions (LPKD), agroforestry groups, social forestry organizations, land rehabilitation groups, and women's groups, were formally integrated into project structures. This reflects a significant expansion of opportunities for community engagement in conservation and enterprise development. However, the degree of involvement varied considerably across groups and villages, suggesting that structural inclusion did not always translate into substantive participation.

Table 1. Data analysis methods

Assessment component	Indicators	Collection and validation methods	Analytical approach
Governance performance	Stakeholder roles, participation, legitimacy, equity, integration, institutional capacity	Structured surveys (940 respondents); Cluster-based FGDs (6 clusters)	Descriptive statistics; quasi-interval scaling; cross-cluster comparison
Socio-economic outcomes	Knowledge adoption, livelihood activities, income, poverty (PPI)	Structured surveys; document and literature review	Descriptive analysis; contribution-based interpretation

Table 2. The role and engagement of stakeholders in Lore Lindu Landscape Governance, Indonesia under the Forest Program III Project

Stakeholder category	Entity	Governance role	Direct beneficiary assessment of conservation impact
External Stakeholders	Consortium of NGOs	Facilitation of participatory land use planning at the village level	Low
	Consortium of Universities	Conducting research	Low
Secondary Stakeholders	Lore Lindu National Park Authority (*Balai Besar Taman Nasional Lore Lindu/ BBTNLL*)	Conducting conservation of natural resources and ecosystems in the LLNP area Building conservation partnerships with communities and facilitating the strengthening of *LPKD*	High
	Palu Poso Water Sheed Management Authority (*Balai Pengelolaan Daerah Aliran Sungai Palu Poso/ BPDAS Palu Poso*	Watershed preservation Forest and land rehabilitation (*Rehabilitasi hutan dan lahan/RHL*) Establish and facilitate the strengthening of Land Rehabilitation groups and agroforestry groups	High
	Social Forestry and Environmental Partnership Center of Sulawesi Region (*Balai Perhutanan Sosial dan Kemitraan Lingkungan/BPSKL Wilayah Sulawesi)*	Facilitation of strengthening social forestry groups and women's groups	High
	Regional Technical Implementation Unit for three Forest Management Units (i.e. FMU Kulawi, FMU Sintuvu Maroso and FMU Dolago Tanggunung)	Facilitating the formation and strengthening of social forestry groups	Very Low
Primary Stakeholders	48 Village Governments	Facilitating the Establishment of Forest Conservation Groups and Institutions Planning and Monitoring of Village-Level Conservation Programs	High
	40 Village-Based Conservation Management Institutions *(Lembaga Konservasi Desa/LPKD)*	Utilise, manage, and conserve the forest resources of the traditional zone of the LLNP forest area	High
	75 Agroforestry Farmer Groups	Developing agroforestry systems	High
	39 Land Rehabilitation Groups	Undertaking rehabilitation activities programmed by Palu Poso Water Sheed Management Authority	Very Low
	14 Social Forestry (SF) Organizations/Entities	Planning and implementing forest management in each social forestry area Developing social forestry enterprises	Moderate
	22 Women's Community Groups	Participating in forest management Developing enterprises	High

Despite these formal achievements, participation was not consistently equitable. In several cases, membership in FP III-supported groups was dominated by village officials and their close affiliates, limiting the representation of households most dependent on forest resources. This pattern of elite capture reduced the inclusiveness of collaborative governance and constrained the fair distribution of project benefits. Such dynamics are consistent with findings from other decentralized forestry programs, where formal institutions often mask underlying inequalities in participation (Larson and Ribot 2007; Massiri et al. 2023).

Inclusiveness improved through the establishment of women's groups, which engaged in small-scale enterprises such as handicrafts, although their opportunities remained constrained by limited market access and financial resources. At the same time, livelihood participation at the broader community level was limited, as most households relied on forest resources primarily for subsistence rather than commercial purposes. As shown in Figure 4, only a minority of households actively engaged in commercial forest use, indicating that forest resources were primarily used to meet subsistence needs. The underlying factors for this limited engagement are discussed in the subsequent section.

Socio-economic outcomes

FP III aimed to improve community welfare by promoting sustainable land-use practices, particularly land rehabilitation, agroforestry development, and the use of organic fertilizers. These interventions were implemented in ecologically sensitive areas, including riparian buffers, spring catchments, and steep slopes. Nevertheless, challenges persisted: many households continued to cultivate riverbanks and slopes exceeding 30° to meet immediate livelihood needs. Such practices jeopardize ecosystem services and highlight the tension between short-term economic necessities and long-term conservation objectives. As illustrated in Figure 5, cultivation in critical zones remains common across several clusters, underscoring the limited effectiveness of

institutional safeguards in curbing environmentally harmful practices.

The agricultural activities within the National Park, predominantly cocoa, coffee, and candlenut, are largely concentrated in designated traditional zones. These zones formally recognize long-standing community access and existing land use. Under the FP III framework, these activities are regulated through conservation agreements to ensure they remain sustainable and do not encroach on the national park's core.

With respect to livelihood participation, FP III encouraged the adoption of sustainable agricultural innovations. Agroforestry systems and organic fertilizer practices were increasingly adopted, particularly in Clusters 2 and 3, where adoption exceeded 40% of surveyed households. Women's groups and LPKDs contributed through small-scale enterprises such as handicrafts and organic fertilizer production, reflecting progress toward gender inclusion. However, their economic contributions remained constrained by limited access to markets and capital. The uptake of other practices, including biopesticides and soil-water conservation techniques, was relatively modest. As shown in Figure 6, adoption patterns varied substantially across clusters, indicating that while structural participation improved, livelihood participation and technological integration were uneven.

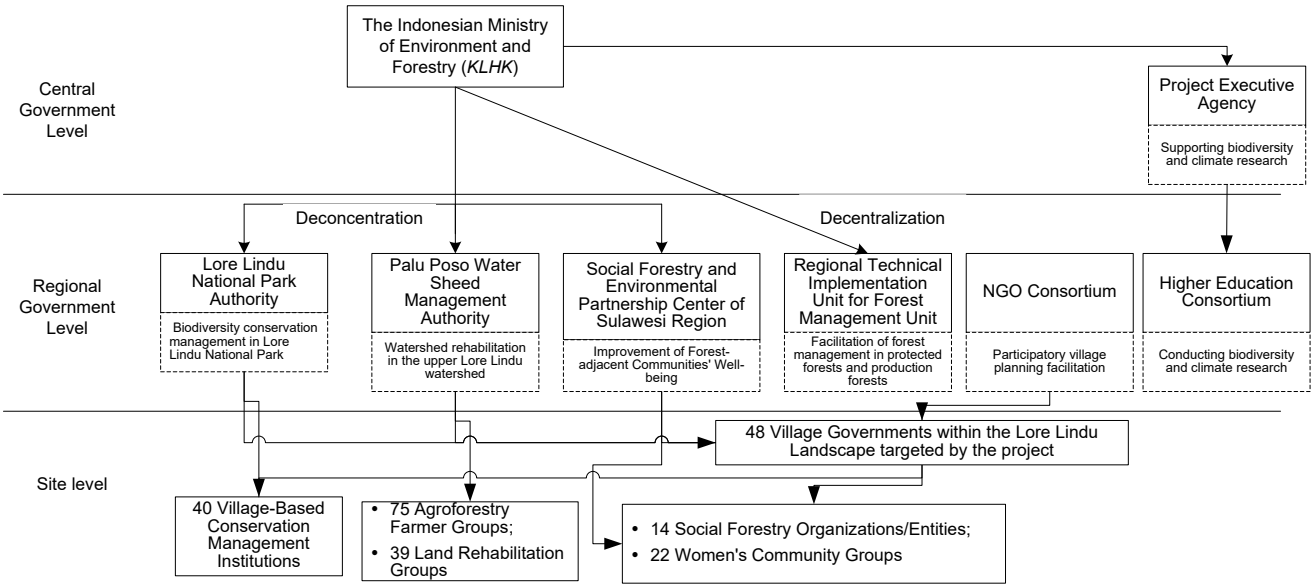
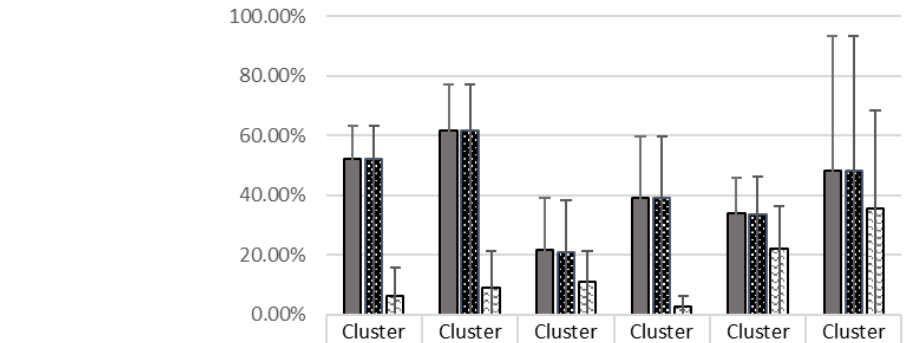
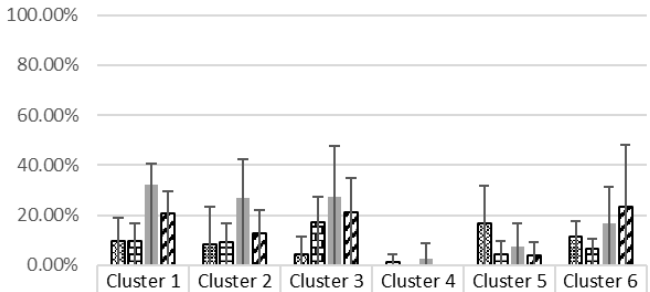


Figure 3. Structure of community-based collaborative governance in the Lore Lindu Landscape, Indonesia



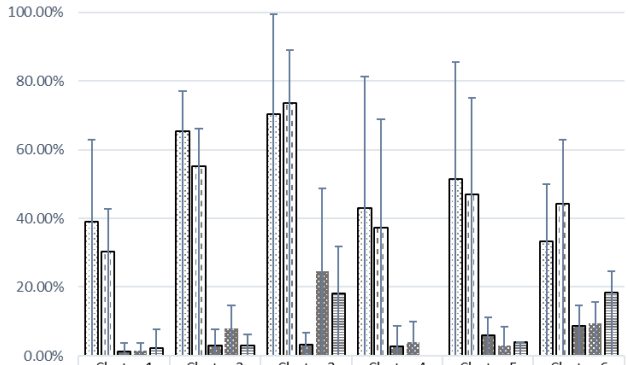
	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Respondents Utilizing Resources in Forest Areas	51.94%	61.60%	21.77%	38.93%	34.00%	48.00%
Subsistence Utilization	51.94%	61.60%	21.00%	38.93%	33.33%	48.00%
Commercial Utilization	6.22%	9.12%	10.74%	2.67%	21.83%	35.33%

Figure 4. Profile of beneficiary respondents in forest product utilization projects



	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Respondents Cultivating in Forest Areas	9.56%	8.24%	4.23%	1.33%	16.50%	11.33%
Respondents Cultivating Land Close to Springs	9.78%	9.10%	16.95%	0.00%	4.33%	6.33%
Respondents Cultivating Along Riverbanks	32.28%	26.95%	27.31%	2.67%	7.50%	16.67%
Respondents cultivating on Steep Slope	20.78%	12.64%	21.08%	0.00%	4.00%	23.33%

Figure 5. Land use practices for plantations and agriculture within protected areas by project beneficiaries



	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Respondents Practicing Agroforestry	38.89%	65.24%	70.38%	42.93%	51.33%	33.33%
Respondents Using Organic Fertilizers	30.33%	55.21%	73.56%	37.33%	47.00%	44.33%
Respondents Applying Biopesticides	1.11%	2.89%	3.21%	2.67%	5.83%	8.67%
Respondents Practicing Traditional Pest Control	1.39%	7.91%	24.59%	4.00%	3.00%	9.33%
Respondents Applying Soil and Water Conservation Techniques	2.22%	3.02%	18.18%	0.00%	4.00%	18.33%

Figure 6. Description of sustainable agricultural practice by project beneficiary respondents

The economic outcomes of FP III also varied. On average, forest-based activities contributed to 28.23% of household income, with the highest share in Cluster 1 (41.8%) but involving only 6.22% of households. By contrast, Cluster 6 showed much broader household participation (35.3%) with moderate income contributions. As presented in Table 3, forest-derived income generally remained supplementary rather than a primary livelihood source.

This pattern indicates that higher income contributions were concentrated among a small number of households, while broader participation was associated with more modest income gains. The findings revealed that during the implementation of FP III, poverty levels among surveyed households declined, suggesting a positive socio-economic contribution of the program. Nevertheless, this outcome cannot be attributed solely to FP III, as broader economic trends and other government interventions may also have played a role. What is notable, however, is that the rate of poverty reduction among FP III respondents was higher than the decline reported in official BPS statistics for the same period. This indicates that FP III likely reinforced existing poverty alleviation efforts, even though its impacts were uneven across clusters. Significant reductions were recorded in Clusters 2-5, whereas decreases in Cluster 1 were not statistically significant (Table 4).

To provide a clearer cross-cluster perspective, Table 5 summarizes socio-economic outcomes, including adoption of sustainable practices, household engagement in commercial forest use, average forest income, and changes in PPI scores. This comparison highlights that FP III's socio-economic impacts were unevenly distributed: some clusters demonstrated broad-based adoption and measurable poverty reduction, while others showed limited livelihood improvements despite higher average income contributions.

Table 3. Summary of forest-related income and economic contribution

Cluster	Total villages (N)	Villages with forest-related income (n)	Number of respondents commercially using forest products	Average forest income per respondent (IDR)	Std deviation (IDR)	Average contribution (%)	Std. deviation (%)
Cluster 1	6	3	6.22%	1,653,889	1,347,181	41.77	33.41
Cluster 2	9	8	9.12%	730,781	511,923	24.67	9.43
Cluster 3	13	6	10.74%	937.083	745,202	24.46	19.31
Cluster 4	5	2	2.67%	791,000	330,825	23.56	5.49
Cluster 5	10	7	21.83%	1,128,120	676,228	30.70	18.25
Cluster 6	5	3	35.33%	1,472,920	558,518	29.13	22.84
Total	48	29					

Table 4. Descriptive comparison of PPI score changes across clusters

Pair	Mean	Std. Deviation	Std. Error Mean	95% Confident Interval of Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
CL1 Before - CL1 After	0.01667	0.01751	0.00715	-0.00171	0.03504	2.331	5	0.067
CL 2 Before - CL 2 After	0.02778	0.01481	0.00494	0.01639	0.03916	5.625	5	0.000
CL 3 Before - CL 3 After	0.03154	0.00899	0.00249	0.02611	0.03697	15.653	12	0.000
CL 4 Before - CL 4 After	0.09000	0.01000	0.00447	0.07758	0.10242	20.125	4	0.000
CL 5 Before - CL 5 After	0.03500	0.00850	0.00269	0.02892	0.04108	13.024	9	0.000
CL 6 Before - CL 6 After	0.03400	0.00894	0.00400	0.02289	0.04511	8.500	4	0.001

Note: CL: Cluster

Table 5. Socio-economic outcomes of FP III across clusters

Cluster	Adoption of agroforestry (%)	Use of organic fertilizer (%)	Use of biopesticides (%)	Soil and water conservation (%)	Households with commercial forest use (%)	Average forest income per household (IDR/month)	Contribution of forest income to household income (%)	Change in poverty rate (PPI, %)
Cluster 1	38.89	30.33	1.11	4.23	6.22	1,653,889	41.77	-1.67
Cluster 2	65.24	55.21	2.89	3.02	9.12	730,781	24.67	-2.78
Cluster 3	70.38	73.56	3.21	13.18	10.74	937,083	24.46	-3.15
Cluster 4	42.93	37.33	2.67	0.00	2.67	791,000	23.56	-9.00
Cluster 5	51.33	47.00	5.83	4.00	21.83	1,128,120	30.70	-3.50
Cluster 6	33.33	44.33	8.67	6.33	35.33	1,472,920	29.13	-3.40

Institutional capacity and sustainability

FP III significantly expanded the organizational landscape in the Lore Lindu area by establishing 40 Village Conservation Institutions (LPKD), 75 agroforestry groups, 39 land rehabilitation groups, and 22 women's groups. In addition, several social forestry organizations (such as HKm and HD groups) had been established earlier but were also incorporated into FP III interventions. In terms of institutional capacity, both newly established and pre-existing groups demonstrated relatively similar levels of capacity, as FP III provided systematic training, technical assistance, and participatory planning across all organizations. The critical challenge concerns not their current functionality but their long-term sustainability once external facilitation and resources are withdrawn.

Despite these achievements, institutional performance remained uneven across governance levels. Central technical agencies such as *BBTNLL, BPDAS Palu Poso*, and *BPSKL* continued to dominate facilitation, while regional FMUs, which are mandated to bridge national policies with local implementation, were only marginally involved, particularly in non-park areas. This imbalance reflects a fragmented governance arrangement, where local groups received technical support but lacked consistent coordination and oversight from regional institutions. Weak market linkages and limited access to finance further constrained the ability of these community organizations to sustain economic activities beyond project facilitation.

These patterns raise questions about the long-term sustainability of FP III's institutional impacts. While community-based groups have improved structural capacity, their effectiveness depends on stronger vertical and horizontal linkages among central, regional, and local actors. Without clear role division, FMUs cannot function effectively as bridging institutions, and community organizations risk becoming dependent on project-based

support. In line with the principles of polycentric governance (Ostrom 2010; Carlisle and Gruby 2019), sustaining FP III outcomes will require enhancing coordination across scales, empowering FMUs, and ensuring that local institutions gain access to markets and financial services. Such measures are essential to transform the short-term gains of project facilitation into long-term institutional resilience.

Discussion

This study confirms that collaborative forest governance under the FP III project has strengthened multi-stakeholder collaboration, enhanced sustainable forest and land management practices, and contributed to local livelihoods in the Lore Lindu Landscape. These findings are consistent with a broader body of literature showing that collaborative governance can serve as an effective approach to managing complex landscapes by fostering joint decision-making, trust-building, and accountability among diverse actors (Winter et al. 2021). Similar to experiences in other regions of Southeast Asia, effective collaborative governance requires both vertical linkages across government levels and horizontal cooperation among local institutions to ensure inclusivity and legitimacy (Sattler et al. 2016; Dressel et al. 2021; Cid et al. 2024).

From a socio-economic perspective, the FP III program has promoted agroforestry and sustainable land-use practices, yet the average contribution of forest-based activities to household income remains modest (28.23%). This is consistent with recent reviews showing that while community forestry strengthens natural capital, livelihood benefits often remain limited unless complemented by market access, financial services, and institutional support (Morse and McNamara 2015; Hajjar et al. 2021). This result echoes findings from community forestry initiatives in Java and Kalimantan, where benefits to household livelihoods were also uneven and often supplementary rather than primary sources of income (Santika et al. 2019; Tando et al. 2022). Comparable outcomes are reported in Bangladesh's Sundarbans co-management initiatives (Begum et al. 2021) and in Sub-Saharan Africa, where community-based natural resource management enhances ecological outcomes but faces persistent barriers in market access and value addition (Musavengane et al. 2019; Chirenje et al. 2020). In Latin America, co-management in the Paraguayan Pantanal similarly demonstrated strong conservation outcomes but limited livelihood improvements without market linkages (Eufemia et al. 2019). These cross-regional insights highlight that the challenges observed in Lore Lindu are not unique, but reflect a wider global pattern in which ecological gains are often not matched by equitable economic benefits.

However, a contrasting perspective emerges in Nepal, where community forestry has yielded more substantial and sustained livelihood benefits. Nepal's model is characterized by high levels of community autonomy, legally recognized forest user groups, and decentralized governance arrangements that grant local institutions secure rights to manage and commercialize forest products (Ojha et al. 2016; Paudyal et al. 2017). Over several decades, these institutional features have enabled stronger socio-economic empowerment and accountability at the local level. Compared to this experience, the more modest livelihood outcomes observed in Lore Lindu reflect the constraints of collaborative governance implemented through time-bound, project-based interventions, rather than shortcomings of the collaborative approach itself. This comparison underscores the importance of long-term institutionalization and tenure security in enabling collaborative forest governance to deliver equitable economic benefits. These cross-regional insights highlight that the challenges observed in Lore Lindu are not unique, but reflect a wider global pattern.

These modest livelihood outcomes also help explain why only a minority of households engaged in commercial forest use. Local cultural orientations emphasize subsistence reliance on forest resources rather than their commercialization, while limited market access further constrains opportunities for income generation. In addition, households involved in commercial forest use may not have been adequately represented in FP III-facilitated groups, which could have reduced the visibility of such activities in the study. Similar dynamics of subsistence dominance and weak market integration have been documented in social forestry programs across Indonesia and other tropical regions (Musavengane et al. 2019; Santika et al. 2019; Tando et al. 2022). These findings underscore the importance of addressing both cultural and structural barriers if community forestry is to contribute more substantially to household economies.

The uneven distribution of benefits was particularly evident in cluster 1, where forest-related income made up a large share of household income but involved only a small fraction of households. This indicates that commercial forest use was concentrated among a limited subset of respondents who relied on forests as their primary occupation, while most households continued to treat forests mainly as a source of subsistence. When comparing across clusters, however, average forest income per respondent did not differ substantially, suggesting that the key distinction lies less in income levels and more in the number of households engaged and the extent to which forest use formed part of their main livelihood strategy.

A key factor explaining these limited economic outcomes is local elite capture. In several villages, project-supported groups were dominated by village officials and their affiliates, while many forest-dependent households remained excluded. This was largely due to the fact that group formation and membership were determined by the village head, who often prioritized village apparatus or family members. Project facilitators had little scope to intervene in these arrangements, and political considerations, such as securing support for future village head elections, also influenced membership composition. This mirrors patterns observed in other parts of Indonesia, where local elites often monopolize community forestry institutions (Larson and Ribot 2007; Massiri et al. 2023), and is consistent with findings from Laos, where REDD+ consultations reproduced existing power asymmetries

(Sawathvong et al. 2024). Such dynamics highlight how formal participation structures can obscure underlying inequalities, ultimately constraining the equitable distribution of benefits and eroding community trust in governance institutions. Global studies reinforce that without transparent and inclusive mechanisms, collaborative governance risks reinforcing rather than reducing structural inequities (Bixler et al. 2018; Armitage et al. 2020).

The trade-offs documented in FP III also reflect the wider difficulty of reconciling ecological objectives with immediate livelihood needs. Despite project efforts, many households continue to cultivate steep slopes and riparian zones to secure short-term income. primarily due to land scarcity that compels cultivation in ecologically fragile areas and the prevailing perception that riparian zones offer higher soil fertility, despite being formally designated as protected. These ecologically sensitive lands have therefore become priority targets for agroforestry interventions and rehabilitation programs, which aim to balance livelihood security with ecological restoration. Similar challenges have been documented in Indonesian social forestry programs (Lawasi 2024; Robert et al. 2024) and in other tropical regions such as Latin America (Eufemia et al. 2019) and Africa (Musavengane et al. 2019). These findings affirm that technical training and institutional facilitation alone are insufficient to drive behavioral change; broader structural support is needed in the form of enabling policy frameworks, access to finance, and sustainable market development (Ojha and Hall 2023). This aligns with the principles of adaptive co-management (Armitage et al. 2020), which emphasize iterative learning, flexibility, and the integration of local knowledge into governance processes.

The limited role of Forest Management Units (FMUs) observed under FP III is also rooted in structural and policy-related constraints. Many FMUs in Indonesia remain underfunded and understaffed relative to the extensive mandates assigned to them, which include forest planning, protection and patrol, conservation, land rehabilitation, and community empowerment. Compared to central government technical units under the Ministry of Forestry, such as national park authorities and watershed management agencies, FMUs often lack sufficient personnel, operational budgets, and technical resources to perform these functions effectively. These capacity constraints are further reinforced by recentralization tendencies following Law No. 23/2014, the Job Creation Law (Law No. 11/2020), and its implementing regulation PP No. 23/2021, which shifted administrative authorities and strengthened central oversight in forest governance. As a result, while FMUs are formally designated as key operating and bridging institutions on the ground, their practical role in collaborative governance remains limited. Addressing this structural imbalance is critical if FMUs are to fulfill their intended function in sustaining collaborative forest governance beyond project-based interventions.

The evolving role of government from direct management toward technical facilitation (Ramadhan et al. 2023a) illustrates the logic of polycentric governance (Ostrom 2010), where multiple centers of authority can enhance resilience if they operate in synergy (Carlisle and Gruby 2019). In Lore Lindu, this requires that central units such as *BPSKL* and *BPDAS Palu Poso* work in closer coordination with FMUs, while simultaneously empowering FMUs to fulfill their bridging role between policy frameworks and community practices (Massiri et al. 2020; Ramadhan et al. 2023b). Strengthening FMUs' functional authority is critical to ensure that collaborative governance can persist beyond project cycles.

Overall, the findings generate several concrete policy directions. First, there is a need to establish clear coordination mechanisms between central and regional agencies to reduce overlapping mandates and enhance accountability. Second, greater emphasis should be placed on market facilitation and value-chain development to support the economic viability of community enterprises and agroforestry products. Third, sustained capacity building and organizational strengthening—especially for women's groups, LPKDs, and small-scale enterprises—are essential to ensure inclusivity and long-term institutional resilience. Finally, transparent and accountable decision-making mechanisms are required to address elite capture and guarantee fair participation of forest-dependent households. These recommendations align with global evidence from Southeast Asia (Sawathvong et al. 2024), Sub-Saharan Africa (Musavengane et al. 2019), and Latin America (Sattler et al. 2016; Eufemia et al. 2019), reinforcing that durable collaborative governance depends on institutional pluralism, strong local capacity, and context-specific coordination across scales.

This study thus contributes not only to understanding the dynamics of FP III in Lore Lindu but also to wider debates on the effectiveness of collaborative and polycentric governance in biodiversity-rich landscapes of the Global South. Nevertheless, some limitations remain. The relatively short implementation period does not yet capture long-term institutional dynamics after donor exit, while local political factors and policy uncertainties were not systematically assessed. Future research should therefore adopt longitudinal and comparative designs across multiple landscapes to identify the enabling conditions under which collaborative governance can simultaneously sustain ecological integrity and strengthen community livelihoods.

Following the conclusion of the FP III project in 2024, the sustainability of its interventions increasingly depends on the institutional legacy left behind rather than on continued external facilitation. The persistence of transformative outcomes, such as the average 28.23% contribution of forest-based activities to household income, will largely be shaped by post-project governance arrangements. This study suggests that a critical transition is required from project-driven facilitation toward more autonomous management by community-based institutions, including cooperatives and village-owned enterprises (*BUMDes*). In addition, the long-term integration of collaborative activities into the routine functions and budgetary planning of FMUs and *BBTNLL* is likely to

influence whether socio-economic gains are sustained or gradually diminish over time.

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REFERENCES

Agrawal A, Chhatre A, Hardin R. 2008. Changing governance of the world's forests. Science 320 (5882): 1460-1462. https://doi.org/10.1126/science.1155369.

Andersson KP, Ostrom E. 2008. Analyzing decentralized resource regimes from a polycentric perspective. Policy Sci 41 (1): 71-93. https://doi.org/10.1007/s11077-007-9055-6.

Ansell C, Gash A. 2008. Collaborative governance in theory and practice. J Public Adm Res Theory 18 (4): 543-571. https://doi.org/10.1093/jopart/mum032.

Arai Y, Oktoriana S, Suharyani A, Inoue M. 2021. How can we mitigate power imbalances in collaborative environmental governance? Examining the role of the village facilitation team approach observed in West Kalimantan, Indonesia. Sustainability 13(7): 3972. https://doi.org/10.3390/su13073972.

Armitage D, Mbatha P, Muhl EK, Rice W, Sowman M. 2020. Governance principles for community-centered conservation in the post-2020 global biodiversity framework. Conserv Sci Pract 2 (2): e160. https://doi.org/10.1111/csp2.160.

Begum F, Lobry de Bruyn L, Kristiansen P, Islam MA. 2021. Institutionalising co-management activities for conservation of forest resources: Evidence from the Sundarban mangrove forest management of Bangladesh. J Environ Manag 298: 113504. https://doi.org/10.1016/j.jenvman.2021.113504.

Bixler RP, Dell'Angelo J, Mfune O, Roba H. 2018. The political ecology of participatory conservation: Institutions and power in community-based forest management. Conserv Biol 32 (3): 525-534. https://doi.org/10.1111/cobi.13026.

Carlisle K, Gruby RL. 2019. Polycentric systems of governance: A theoretical model for the commons. Policy Stud J 47 (4): 927-952. https://doi.org/10.1111/psj.12212.

Carlsson L, Berkes F. 2005. Co-management: Concepts and methodological implications. J Environ Manag 75 (1): 65-76. https://doi.org/10.1016/j.jenvman.2004.11.008.

Charmakar S, Kimengsi JN, Giessen L. 2024. Linking institutional change mechanisms with forest management outcomes: Evidence from community forestry in Nepal. Ecol Soc 29 (3): 1. https://doi.org/10.5751/ES-15085-290301.

Chirenje LI, Giliba RA, Musamba EB. 2020. Local communities and forest resource governance in Sub-Saharan Africa: A review. For Policy Econ 113: 102118. https://doi.org/10.1016/j.forpol.2020.102118.

Cid A, Siqueiros-García JM, Mazari-Hiriart M, Guerra A, Lerner AM. 2024. Mobilizing institutional capacities to adapt to climate change: Local government collaboration networks for risk management in Mexico City. npj Clim Action 3: 20. https://doi.org/10.1038/s44168-024-00102-8.

Debie E, Singh KN. 2021. Performance of common pool resources management in the mixed farming system in Goncha District, northwest highlands of Ethiopia. Environ Dev Sustain 23: 8815-8835. https://doi.org/10.1007/s10668-020-00996-4.

Dressel S, Sjölander-Lindqvist A, Johansson M, Ericsson G, Sandström C. 2021. Achieving social and ecological outcomes in collaborative environmental governance: Good examples from Swedish moose management. Sustainability 13 (4): 2329. https://doi.org/10.3390/su13042329.

Emerson K, Nabatchi T, Balogh S. 2012. An integrative framework for collaborative governance. J Public Adm Res Theory 22 (1): 1-29. https://doi.org/10.1093/jopart/mur011.

Eriksson M, Samuelson L, Jägrud L, Mattsson E, Celander T, Malmer A, Bengtsson K, Johansson O, Schaaf N, Svending O, Tengberg A. 2018. Water, forests, people: The Swedish experience in building resilient landscapes. Environ Manag 62: 45-57. https://doi.org/10.1007/s00267-018-1066-x.

Eufemia L, Schlindwein I, Bonatti M, Bayer ST, Sieber S. 2019. Community-based governance and sustainability in the Paraguayan Pantanal. Sustainability 11 (19): 5158. https://doi.org/10.3390/su11195158.

Fischer HW, Chhatre A, Duddu A, Pradhan N, Agrawal A. 2023. Community forest governance and synergies among carbon, biodiversity and livelihoods. Nat Clim Chang 13: 1124-1130. https://doi.org/10.1038/s41558-023-01863-6.

Galudra G. 2019. Focusing on facilitation: Issues and challenges of capacity development in Indonesia's social forestry reforms. For Soc 3 (1): 133-136. https://doi.org/10.24259/fs.v3i1.5995.

Golar G, Muis H, Herman A, Simorangkir WS. 2022. Effectiveness of community-based collaborative forest management of the Forest Programme III in Central Sulawesi. IOP Conf Ser Earth Environ Sci 1114 (1): 012028. https://doi.org/10.1088/1755-1315/1114/1/012028.

Hajjar R, Oldekop JA, Cronkleton P, Etue E, Newton P, Russel AJM, Zhou W. 2021. A global analysis of the social and environmental outcomes of community forests. Nat Sustain 4: 216-224. https://doi.org/10.1038/s41893-020-00633-y.

Khaeruddin I. 2019. The case of the German Technical Cooperation in supporting sustainable resources management in Lore Lindu Biosphere Reserve, Central Sulawesi – Indonesia. IOP Conf Ser Earth Environ Sci 298 (1): 012029. https://doi.org/10.1088/1755-1315/298/1/012029.

Kusters K, de Graaf M, Buck L, Galido K, Maindo A, Mendoza I, Nghi TH, Purwanto E, Zagt R. 2020. Inclusive landscape governance for sustainable development: Assessment methodology and lessons for civil society organizations. Land 9 (4): 128. https://doi.org/10.3390/land9040128.

Larson AM, Ribot JC. 2007. The poverty of forestry policy: Double standards on an uneven playing field. Sustain Sci 2: 189-204. https://doi.org/10.1007/s11625-007-0030-0.

Lawasi MA. 2024. Unveiling the shortcomings of social forestry programs in Indonesia: A critical analysis of farmer empowerment initiatives. Jurnal Sylva Lestari 12 (3): 866-889. https://doi.org/10.23960/jsl.v12i3.945.

Lockwood M, Davidson J, Curtis A, Stratford E, Griffith R. 2010. Governance principles for natural resource management. Soc Nat Resour 23 (10): 986-1001. https://doi.org/10.1080/08941920802178214.

MacKinnon K, Richardson K, MacKinnon J. 2020. Protected and other conserved areas: Ensuring the future of forest biodiversity in a changing climate. Intl For Rev 22 (S1): 93-103. https://doi.org/10.1505/146554820829523943.

Massiri SD, Malik A, Golar, Hamzari, Nugroho B. 2020. Institutional capacity of forest management unit in promoting sustainable community-based forest management: Case study of forest management unit in Central Sulawesi Province, Indonesia. Jurnal Manajemen Hutan Tropika 26 (2): 169-176. https://doi.org/10.7226/jtfm.26.2.169.

Massiri SD, Pribadi H, Anwar, Golar, Naharuddin, Hamzari. 2023. Social capital of the local community in forest conservation for disaster mitigation. IOP Conf Ser: Earth Environ Sci 1209 (6): 012096. https://doi.org/10.1088/1755-1315/1209/6/012096.

Morse S, McNamara N. 2015. Sustainable Livelihood Approach: A Critique of Theory and Practice. Springer, Cham.

Musavengane R, Tantoh HB, Simatele D. 2019. A comparative analysis of collaborative environmental management of natural resources in Sub-Saharan Africa: A study of Cameroon and South Africa. J Asian Afr Stud 54 (4): 512-532. https://doi.org/10.1177/0021909618825276.

Nuñez MA, Barlow J, Cadotte M, Lucas K, Newton E, Pettorelli N, Stephens PA. 2019. Assessing the uneven global distribution of readership, submissions and publications in applied ecology: Obvious problems without obvious solutions. J Appl Ecol 56 (1): 4-9. https://doi.org/10.1111/1365-2664.13319.

Ojha H, Hall A. 2023. Transformation as system innovation: Insights from Nepal's five decades of community forestry development. Innov Dev 13 (1): 67-84. https://doi.org/10.1080/2157930X.2021.1917112.

Ojha HR, Ford R, Keenan RJ, Race D, Vega DC, Baral H, Sapkota P. 2016. Delocalizing communities: Changing forms of community engagement in natural resources governance. World Development 87: 274–290. https://doi.org/10.1016/j.worlddev.2016.06.017.

Ostrom E. 1990. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge. https://doi.org/10.1017/CBO9780511807763.

Ostrom E. 2010. Beyond markets and states: Polycentric governance of complex economic systems. Transnatl Corp Rev 2 (2): 1-12. https://doi.org/10.1080/19186444.2010.11658229.

Paudyal K, Baral H, Lowell K, Keenan RJ. 2017. Ecosystem services from community-based forestry in Nepal: Realising local and global benefits. Land Use Policy 63: 342–355. https://doi.org/10.1016/j.landusepol.2017.01.046.

Peraturan Menteri Lingkungan Hidup dan Kehutanan Nomor 9 Tahun 2021 (Permen LHK No. 9/2021). 2021. Pengelolaan Perhutanan Sosial. Kementerian Lingkungan Hidup dan Kehutanan, Jakarta. https://peraturan.bpk.go.id. [Indonesian]

Peraturan Presiden Republik Indonesia Nomor 88 Tahun 2017 (Perpres No. 88/2017). 2017. Penyelesaian Penguasaan Tanah dalam Kawasan Hutan. Presiden Republik Indonesia, Jakarta. https://peraturan.bpk.go.id. [Indonesian]

Ramadhan R, Dhavio M, Hanafi R, Daulay MH, Prakosa GG. 2023a. Transformation of forest governance: Policy concepts and actor changes in social forestry program implementation in Indonesia. Intl For Rev 25 (1): 92-104. https://doi.org/10.1505/146554823836838673.

Ramadhan R, Karim S, Fisher MR, Mursyid H, Indrawan M. 2023b. Assessing the governance modes of Indonesia's forest management unit. In: Triyanti A, Indrawan M, Nurhidayah L, Marfai MA (eds.). Environmental Governance in Indonesia. Environment & Policy, vol 61. Springer, Cham. https://doi.org/10.1007/978-3-031-15904-6_9.

Reed J, Ickowitz A, Chervier C, Djoudi H, Moombe K, Ros-Tonen M, Yanou M, Yuliani L, Sunderland T. 2020. Integrated landscape approaches in the tropics: A brief stock-take. Land Use Policy 99: 104822. https://doi.org/10.1016/j.landusepol.2020.104822.

Robert S, Laely N, Herman H, Dicky R, Sulistya E. 2024. Forest conservation and joint forest management with local community in upstream Jeneberang Watershed of Manimbahoi Village, South Sulawesi, Indonesia. J Trop For Sci 36 (1): 13-25. https://doi.org/10.26525/jtfs2024.36.1.13.

Roengtam S, Agustiyara A. 2022. Collaborative governance for forest land use policy implementation and development. Cogent Soc Sci 8 (1): 2073670. https://doi.org/10.1080/23311886.2022.2073670.

Santika T, Wilson KA, Budiharta S, Kusworo A, Meijaard E, Law EA, Friedman R, Hutabarat JA, Indrawan TP, St. John FAV, Struebig MJ. 2019. Heterogeneous impacts of community forestry on forest conservation and poverty alleviation: Evidence from Indonesia. People Nat 1 (2): 204-219. https://doi.org/10.1002/pan3.25.

Sattler C, Schröter B, Meyer A, Giersch G, Meyer C, Matzdorf B. 2016. Multilevel governance in community-based environmental management: A case study comparison from Latin America. Ecol Soc 21 (4): 24. https://doi.org/10.5751/ES-08475-210424.

Sawathvong S, Hyakumura K, Fujisaki T. 2024. Stakeholder participation in REDD+ program: The case of the consultation process in Laos. Land 13 (8): 1137. https://doi.org/10.3390/land13081137.

Suni MA, Basoka MD, Maarif F, Mappatoba CA, Al-Azhar MR. 2025. Modeling of landslide susceptibility in the core zone of the Lore Lindu Biosphere Reserve using GIS. JBL 8 (1): 57-73. https://doi.org/10.29303/jbl.v8i1.1029.

Swette B, Huntsinger L, Lambin EF. 2023. Collaboration in a polarized context: Lessons from public forest governance in the American West. Ecol Soc 28 (1): 29. https://doi.org/10.5751/ES-13958-280129.

Tajuddin T, Supratman S, Salman D, Yusran Y. 2019. Bridging social forestry and forest management units: Juxtaposing policy imaginaries with implementation practices in a case from Sulawesi. For Soc 3 (1): 97-113. https://doi.org/10.24259/fs.v3i1.6049.

Tando CE, Sudarmo, Haryanti RH. 2022. Collaborative governance effort to manage forest in Kalimantan Island: Literature review. Jurnal Manajemen Hutan Tropika 28 (1): 15-25. https://doi.org/10.7226/JTFM.28.1.15.

Watson JEM, Evans T, Venter O et al. 2018. The exceptional value of intact forest ecosystems. Nat Ecol Evol 2 (4): 599-610. https://doi.org/10.1038/s41559-018-0490-x.

Winkler K, Fuchs R, Rounsevell M, Herold M. 2021. Global land use changes are four times greater than previously estimated. Nat Commun 12: 2501. https://doi.org/10.1038/s41467-021-22702-2.

Winter KB, Vaughan MB, Kurashima N, Giardina C, Quiocho K, Chang K, Akutagawa M, Beamer K, Berkes F. 2021. Empowering indigenous agency through community-driven collaborative management to achieve effective conservation: Hawai'i as an example. Pac Conserv Biol 27 (4): 337-344. https://doi.org/10.1071/PC20009.