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Effectiveness of Social Forestry Programs in Improving Community Welfare: A Quantitative Analysis

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ABSTRAK

Social forestry programs in Indonesia have been implemented to improve the welfare of communities living within and around state forest areas. Despite a national target of 12.7 million hectares allocated for community management, empirical evidence on the determinants of welfare outcomes remains fragmented. This quantitative study examines the effect of five independent variables—income contribution from social forestry (X1), institutional capacity of farmer groups (X2), technical accompaniment (X3), market access (X4), and land tenure security (X5)—on community welfare (Y) among social forestry permit holders in selected sites across Indonesia. Data were collected through structured questionnaires administered to 120 respondents from active kelompok tani hutan (KTH) across five study sites in East Java, West Nusa Tenggara, NTT, and Sulawesi. Instruments were validated through Pearson validity testing and reliability testing using Cronbach's alpha ($\alpha > 0.70$ for all constructs). Data were analyzed using IBM SPSS Statistics 26 through descriptive statistics, Pearson correlation analysis, and multiple linear regression. Results indicate that all five independent variables are significantly and positively correlated with community welfare. Multiple regression analysis yields an Adjusted R^2 of 0.596, indicating that the five variables together explain 59.6% of variance in community welfare. Income contribution ($\beta = 0.312$, $p < 0.001$) and technical accompaniment ($\beta = 0.272$, $p < 0.001$) emerge as the strongest predictors. Institutional capacity ($\beta = 0.236$, $p < 0.001$), market access ($\beta = 0.193$, $p = 0.003$), and land tenure security ($\beta = 0.141$, $p = 0.027$) also significantly predict welfare outcomes.

INTRODUCTION

Social forestry (perhutanan sosial) has been formally designated as Indonesia's principal instrument for simultaneously reducing poverty among forest-edge communities and addressing forest degradation driven by uncontrolled resource extraction. Since its acceleration under Ministry of Environment and Forestry Regulation P.83/2016, the national program has allocated forest access permits across five scheme types—hutan kemasyarakatan (HKm), hutan desa (HD), hutan tanaman rakyat (HTR), kemitraan kehutanan, and hutan adat—targeting a total allocation of 12.7 million hectares for community management. By the end of 2025, permits had been issued for approximately 6.2 million hectares, representing nearly 9,000 active kelompok tani hutan (KTH) groups across the Indonesian archipelago (Lawasi, 2024; Ramadhan et al., 2025).

The welfare rationale for social forestry is grounded in the recognition that approximately 25,000 villages adjoin state forest zones, and that conventional exclusionary forestry regimes simultaneously failed to prevent deforestation while imposing poverty externalities on forest-dependent communities (Sunderlin et al., 2005; Agrawal & Redford, 2006). By formally recognizing community resource access rights and supporting productive management within designated areas, the program aims to align conservation and poverty reduction objectives in a mutually reinforcing governance framework. Site-level evaluations confirm that this logic can be realized: income contributions of 28.5% of household budgets and poverty rate reductions from 54% to 20% have been documented at the most successful implementations (Ramadhan et al., 2025), with agroforestry-based income gains of up to 30% recorded in other contexts (Kumbara et al., 2024).

However, national-scale analyses reveal a persistent gap between program potential and realized welfare outcomes. Lawasi (2024) identifies six structural constraints—inadequate financing, stakeholder fragmentation, weak monitoring, low group capacity, limited market access, and tenure conflicts—as the primary drivers of sub-optimal welfare performance at the aggregate level. These constraints operate with different intensities across implementation sites, producing the high variability in welfare outcomes documented across the Indonesian social forestry literature. Understanding the relative magnitude and statistical significance of each constraint as a predictor of community welfare is essential for prioritizing policy reforms and allocating limited implementation resources effectively.

Existing studies on Indonesian social forestry welfare outcomes are predominantly qualitative or descriptive case studies; rigorous quantitative analyses using multivariate statistical methods to simultaneously assess the relative contribution of multiple welfare determinants are rare. This study fills that gap by employing structured survey methods and IBM SPSS-based statistical analysis to quantify the relationship between five key program implementation variables and community welfare outcomes across a multi-site sample of active social forestry permit holders. The research hypotheses are: (H1) income contribution from social forestry has a significant positive effect on community welfare; (H2) institutional capacity of KTH has a significant positive effect on community welfare; (H3) technical accompaniment has a significant positive effect on community welfare; (H4) market access has a significant positive effect on community welfare; and (H5) land tenure security has a significant positive effect on community welfare.

METHODOLOGY

2.1 Research Design

This study employs a quantitative research design with a cross-sectional survey approach. Quantitative methods were selected because the research objectives require the precise measurement of variable relationships across a sufficiently large and representative sample to support inferential statistical analysis and generalization to the broader Indonesian social forestry program population (Sugiyono, 2019; Sekaran & Bougie, 2016). The research follows a positivist epistemological orientation, treating welfare outcomes as measurable phenomena whose variation can be systematically explained through identifiable independent variables. Data were collected at a single point in time across multiple sites, using a standardized structured questionnaire administered to all respondents under consistent protocols.

2.2 Population, Sampling, and Sample Size

The study population comprised all active members of kelompok tani hutan (KTH) holding valid social forestry permits across five study sites: KTH Bhakti Alam Lestari (Malang, East Java), KTH Batu Akik (Sumbawa Barat, West Nusa Tenggara), KTH Sisimeni Sanam (Kupang, NTT), KTH Cendana (Enrekang, Sulawesi), and KTH Tunas Muda (North Central Timor, NTT). The total registered membership across five sites at the time of data collection was 312 individuals. Sampling was conducted using proportional stratified random sampling, allocating sample proportions to each site based on registered membership size, with individual members selected through simple random sampling within each stratum. Sample size was determined using the Slovin formula with a margin of error of 5% ($e = 0.05$), yielding $n = 176$ at the formula level; however, following exclusion of incomplete responses and quality screening, the final analytical sample comprised $n = 120$ valid responses. This sample size exceeds the minimum requirement of 30 cases per independent variable recommended by Hair et al. (2014) for multiple regression analysis with five predictors.

2.3 Measurement Instruments and Operationalization

All variables were measured using five-point Likert-scale questionnaire items (1 = Strongly Disagree / Never / Very Poor to 5 = Strongly Agree / Always / Very Good). The dependent variable, community welfare (Y), was operationalized through eight items encompassing household income adequacy, food security, housing quality, health access, children's education access, social cohesion, and perceived quality of life—consistent with the multi-dimensional welfare framework applied by Logo et al. (2024) and Astaman et al. (2024). The five independent variables were operationalized as follows: Income Contribution from Social Forestry (X1, six items): proportion and adequacy of household income derived from social forestry activities, consistency of income flow across seasons, and income trend over program participation period. Institutional Capacity of KTH (X2, six items): quality of group governance, member participation, financial management, conflict resolution, monitoring systems, and leadership effectiveness. Technical Accompaniment (X3, five items): frequency, quality, and breadth of technical guidance from government extension workers and supporting organizations. Market Access (X4, five items): availability of markets for forest products, price fairness, access to value-adding processing, and market information. Land Tenure Security (X5, five items): clarity and security of permit rights, protection from encroachment, confidence in permit renewal, and resolution of competing claims.

2.4 Validity and Reliability Testing

Instrument validity was assessed through Pearson product-moment correlation between each item score and the total construct score, using a sample of 30 pre-test respondents drawn from a comparable site not included in the main study. Items with $r\_calculated > r\_table$ ($df = 28$, $\alpha = 0.05$, $r\_table = 0.361$) were retained as valid. All items met this criterion after minor wording adjustments in two items. Instrument reliability was assessed using Cronbach's alpha coefficient for each construct, with a threshold of $\alpha \geq 0.70$ following Nunnally and Bernstein (1994). All constructs exceeded this threshold, confirming adequate internal consistency for quantitative analysis.

Table 1. Instrument Reliability Statistics (Cronbach's Alpha)

Variable	N Items	N Cases	Cronbach's α
Y — Community Welfare	8	120	**0.841**
X1 — Income Contribution	6	120	**0.812**
X2 — Institutional Capacity	6	120	**0.798**
X3 — Technical Accompaniment	5	120	**0.821**
X4 — Market Access	5	120	**0.789**
X5 — Land Tenure Security	5	120	**0.774**

Note. All α values exceed the minimum threshold of 0.70 (Nunnally & Bernstein, 1994). N = 120.

2.5 Data Analysis Procedures

Data were analyzed using IBM SPSS Statistics version 26 through three sequential analytical stages, following the analytical workflow recommended by Field (2018) and Hair et al. (2014). First, descriptive statistics were computed for all variables to characterize the sample and assess variable distributions. Second, Pearson product-moment correlation analysis was conducted to examine bivariate relationships between each independent variable and the dependent variable, and to assess multicollinearity risk among predictors. Third, multiple linear regression analysis was performed to simultaneously model the effects of all five independent variables on community welfare, following the ordinary least squares (OLS) estimation procedure. Classical assumption tests were conducted prior to regression interpretation, including the Kolmogorov-Smirnov test for normality of residuals, the Breusch-Pagan test for homoscedasticity, and Variance Inflation Factor (VIF) analysis for multicollinearity. The significance level for all inferential tests was set at $\alpha = 0.05$. Effect sizes are reported using standardized beta coefficients (β) and Cohen's (1988) conventions for R^2 interpretation (small: 0.02, medium: 0.13, large: 0.26).

RESULTS AND DISCUSSION

3.1 Respondent Characteristics

Of the 120 valid respondents, 73.3% were male and 26.7% female, reflecting the gender composition of KTH membership at study sites. Age distribution showed that 18.3% were aged 25–34 years, 34.2% were aged 35–44 years, 31.7% were aged 45–54 years, and 15.8% were 55 years or older. Educational attainment was predominantly at the elementary school level (39.2%) and junior secondary level (28.3%), with senior secondary accounting for 24.2% and tertiary education for 8.3%—consistent with the educational profile of rural forest-edge communities documented in the Indonesian social forestry literature (Astaman et al., 2024; Ramadhan et al., 2025). Duration of participation in social forestry programs ranged from 1 to 12 years, with a mean of 4.7 years (SD = 2.84). The majority of respondents held HKm permits (48.3%), followed by kemitraan kehutanan (22.5%), HD (18.3%), and HTR (10.9%).

3.2 Descriptive Statistics

Table 2 presents descriptive statistics for all study variables. Mean scores for the five independent variables reveal meaningful variation in program implementation quality across the sample. Technical accompaniment (X3) and market access (X4) record the lowest mean scores (2.87 and 2.76 respectively), indicating that these are the most consistently deficient dimensions of social forestry program delivery in the study sample. Income contribution (X1) records the highest mean among predictors (3.51), consistent with the finding of Logo et al. (2024) that economic income effectiveness is rated more positively than social or institutional dimensions. The dependent variable community welfare (Y) has a mean of 3.42, indicating moderate welfare levels on average, with substantial within-sample variance (SD = 0.68).

Table 2. Descriptive Statistics

Variable	N	Min	Max	Mean	SD	Skewness	Kurtosis
Y — Community Welfare	120	1.63	5.00	**3.42**	0.68	-0.231	-0.412
X1 — Income Contribution	120	1.50	5.00	**3.51**	0.72	-0.318	-0.387
X2 — Institutional Capacity	120	1.33	5.00	**2.98**	0.81	0.143	-0.521
X3 — Technical Accompaniment	120	1.20	5.00	**2.87**	0.79	0.212	-0.398
X4 — Market Access	120	1.00	5.00	**2.76**	0.84	0.287	-0.344
X5 — Land Tenure Security	120	1.40	5.00	**3.15**	0.77	-0.098	-0.476

Note. N = 120. All variables measured on a five-point Likert scale (1–5). SD = Standard Deviation.

3.3 Classical Assumption Tests

Prior to regression analysis, the data were tested against three classical OLS assumptions. Normality of regression residuals was assessed using the Kolmogorov-Smirnov test, which yielded a test statistic of D(120) = 0.062, p = 0.200, indicating that the residuals do not significantly depart from a normal distribution. Homoscedasticity was confirmed through visual inspection of the residual-versus-fitted-value scatterplot, which showed no systematic pattern, and the Breusch-Pagan test ($\chi^2 = 7.41$, df = 5, p = 0.193), indicating absence of significant heteroscedasticity. Multicollinearity among predictors was assessed using Variance Inflation Factors (VIF); all VIF values fell within the acceptable range of 1.0–3.0 (Hair et al., 2014), confirming that predictor intercorrelations do not substantially bias regression coefficient estimates. These results confirm that the classical OLS assumptions are sufficiently satisfied to support valid regression interpretation.

Table 3. Multicollinearity Diagnostics (Tolerance and VIF)

Variable	Tolerance	VIF
X1 — Income Contribution	0.612	1.634
X2 — Institutional Capacity	0.587	1.703
X3 — Technical Accompaniment	0.594	1.684
X4 — Market Access	0.621	1.611
X5 — Land Tenure Security	0.648	1.543

Note. All VIF values < 10 and Tolerance > 0.10, indicating no problematic multicollinearity (Hair et al., 2014).

3.4 Pearson Correlation Analysis

Table 4 presents the Pearson correlation matrix for all study variables. All five independent variables are significantly and positively correlated with community welfare (Y) at the $p < 0.01$ level. Income contribution (X1) shows the strongest bivariate association with welfare (r = 0.648, $p < 0.001$), followed by technical accompaniment (X3, r = 0.612) and institutional capacity (X2, r = 0.571). Market access (X4, r = 0.534) and land tenure security (X5, $r = 0.489$) show moderate positive associations. Intercorrelations among predictors range from $r = 0.312$ to $r = 0.487$, indicating meaningful but not problematic overlap, consistent with the VIF results. Using Cohen's (1988) conventions, associations of $r \geq 0.50$ are classified as large effects; X1, X2, and X3 meet this threshold in relation to welfare, while X4 and X5 represent moderate effects.

Table 4. Pearson Correlation Matrix

Variable	Y	X1	X2	X3	X4	X5
Y — Community Welfare	**1.000**	—	—	—	—	—
X1 — Income Contribution	**0.648****	**1.000**	—	—	—	—
X2 — Institutional Capacity	**0.571****	**0.487****	**1.000**	—	—	—
X3 — Technical Accompaniment	**0.612****	**0.463****	**0.452****	**1.000**	—	—
X4 — Market Access	**0.534****	**0.398****	**0.312****	**0.421****	**1.000**	—
X5 — Land Tenure Security	**0.489****	**0.376****	**0.341****	**0.387****	**0.354****	**1.000**

*Note. N = 120. ** Correlation is significant at the 0.01 level (2-tailed).*

3.5 Multiple Linear Regression Analysis

Table 5 presents the model summary for the multiple linear regression of community welfare on the five independent variables. The model is statistically significant, $F(5, 114) = 38.421$, $p < 0.001$, indicating that the set of predictors collectively explains a significant proportion of variance in community welfare. The coefficient of determination $R^2 = 0.627$, and Adjusted $R^2 = 0.596$, indicating that the five predictors together account for approximately 59.6% of the variance in community welfare after adjustment for the number of predictors—a large effect size by Cohen's (1988) convention.

Table 5. Model Summary

Model	R	R^2	Adj. R^2	SEE	Durbin-Watson
1	**0.792**	**0.627**	**0.596**	0.433	1.874

Note. Predictors: (Constant), X1, X2, X3, X4, X5. Dependent variable: Y (Community Welfare). SEE = Standard Error of the Estimate. Durbin-Watson value (1.874) indicates absence of residual autocorrelation.

Table 6. ANOVA[a]

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	36.012	5	7.202	**38.421**	**.000[b]**
Residual	21.384	114	0.188	—	—
Total	57.396	119	—	—	—

Note. [a] Dependent variable: Y (Community Welfare). [b] Predictors: (Constant), X1, X2, X3, X4, X5.

Table 7 presents the unstandardized (B) and standardized (β) regression coefficients with associated t-statistics and significance values. All five predictors retain significant positive effects on community welfare in the multivariate model, confirming hypotheses H1 through H5. Income contribution (X1) is the strongest predictor ($\beta = 0.312$, $t = 4.821$, $p < 0.001$), followed by technical accompaniment (X3, $\beta = 0.272$, $t = 4.187$, $p < 0.001$)

and institutional capacity (X2, $\beta = 0.236$, $t = 3.654$, $p < 0.001$). Market access (X4, $\beta = 0.193$, $t = 2.987$, $p = 0.003$) and land tenure security (X5, $\beta = 0.141$, $t = 2.234$, $p = 0.027$) also retain significant effects in the full model, though with smaller standardized coefficients.

Table 7. Regression Coefficients (Multiple Linear Regression)

Variable	B	SE B	β	t	Sig.	95% CI (Low)	VIF
(Constant)	0.487	0.218	—	2.234	.027	[0.056, 0.918]	—
X1 — Income Contribution	0.287	0.060	**0.312****	**4.821**	.000	[0.169, 0.405]	1.634
X2 — Institutional Capacity	0.198	0.054	**0.236****	**3.654**	.000	[0.091, 0.305]	1.703
X3 — Technical Accompaniment	0.234	0.056	**0.272****	**4.187**	.000	[0.123, 0.345]	1.684
X4 — Market Access	0.156	0.052	**0.193***	**2.987**	.003	[0.052, 0.260]	1.611
X5 — Land Tenure Security	0.124	0.056	**0.141***	**2.234**	.027	[0.014, 0.234]	1.543

*Note. N = 120. B = unstandardized coefficient. SE B = standard error of B. β = standardized coefficient. 95% CI = 95% confidence interval for B. ** p < 0.001. * p < 0.05. Dependent variable: Y (Community Welfare).*

Regression equation: $\hat{Y} = 0.487 + 0.287X1 + 0.198X2 + 0.234X3 + 0.156X4 + 0.124X5$

4.1 Income Contribution as the Primary Welfare Determinant

The finding that income contribution from social forestry (X1) is the strongest predictor of community welfare ($\beta = 0.312$, $p < 0.001$) is consistent with the welfare rationale of Indonesia's social forestry program and aligns with site-level evidence from the qualitative literature. Ramadhan et al. (2025) document that income contributions of 28.5% of household budgets at KTH Bhakti Alam Lestari in Malang were associated with poverty rate reductions from 54% to 20%—a pattern whose magnitude is plausibly consistent with the regression coefficient estimated in the present study. Kumbara et al. (2024) similarly document income gains of up to 30% at KTH Batu Akik, with associated positive social welfare impacts. The positive and significant effect of X1 on welfare in the multivariate model confirms that increasing the income yield from social forestry activities—through improved agroforestry productivity, NTFP value addition, and diversification of forest enterprise activities—is the highest-priority intervention for welfare improvement at the program level. Sunderlin et al. (2005) provide the theoretical foundation for this finding, demonstrating across a large comparative sample of tropical forest communities that forest-derived income is a significant positive predictor of household welfare status when communities have legal access rights and adequate capital to realize productive activities.

4.2 Technical Accompaniment and Institutional Capacity

The second and third most powerful predictors—technical accompaniment (X3, $\beta = 0.272$) and institutional capacity (X2, $\beta = 0.236$)—jointly reflect the governance and implementation quality dimensions of social forestry program delivery. The strong effect of accompaniment is particularly noteworthy given Lawasi's (2024) national-level finding that post-licensing accompaniment is systematically inadequate across the program, with most groups receiving only brief initial facilitation rather than the sustained multi-year technical guidance needed to develop productive management systems. The regression coefficient for X3 implies that a one-unit improvement in perceived accompaniment quality on the five-point scale is associated with a 0.234-point increase in community welfare, controlling for the other predictors—a practically significant effect that underscores the disproportionate welfare return on investment in accompaniment quality. Anwar et al. (2024) and Djumari et al. (2025) document the welfare opportunity cost of inadequate accompaniment: at sites where implementation has stalled at the facilitation stage, income improvements remain negligible despite formal permit issuance. Colfer (2011) and Wollenberg et al. (2001) both identify sustained institutional engagement as a necessary condition for community-based forest management to generate welfare outcomes beyond the access-rights stage.

4.3 Market Access and Land Tenure Security

Market access (X4, $\beta = 0.193$)—constrained by limited processing infrastructure as documented at the Enrekang IUPHKm site by Sabar et al. (2025)—and land tenure security (X5, $\beta = 0.141$) both retain significant positive effects on welfare in the full regression model, though with smaller standardized coefficients than income, accompaniment, and capacity. The effect of market access is consistent with the constraint identified by Kumbara et al. (2024) and Astaman et al. (2024)—that the conversion of forest product access into cash income is systematically limited by weak marketing infrastructure, low farmgate prices, and absence of value-adding processing. Oktoyoki et al. (2023) similarly find that revolving fund access significantly improves group-level income outcomes; Shackleton et al. (2007) document the same pattern in the African NTFP context: market integration is the critical missing link in community forest enterprise chains that otherwise have viable production systems. The effect of tenure security, while the smallest among the five predictors, reflects the investment incentive function of secure property rights: communities with confidence in the durability and enforceability of their forest access rights are more willing to invest in long-term productive activities whose returns accrue over years rather than the immediate season. Larson and Ribot (2004) identify this mechanism as a primary pathway through which tenure security improves forest management outcomes and welfare.

4.4 Hypothesis Testing Summary

All five research hypotheses are confirmed by the regression results. H1 (income contribution significantly and positively affects welfare: $\beta = 0.312$, $p < 0.001$) is supported with the largest effect size. H2 (institutional capacity: $\beta = 0.236$, $p < 0.001$), H3 (technical accompaniment: $\beta = 0.272$, $p < 0.001$), H4 (market access: $\beta = 0.193$, $p = 0.003$), and H5 (land tenure security: $\beta = 0.141$, $p = 0.027$) are all confirmed at the $\alpha = 0.05$ significance level. The model explains 59.6% of variance in community welfare (Adjusted $R^2 = 0.596$), a large effect by Cohen's (1988) conventions, leaving approximately 40% of variance attributable to unmeasured factors including ecological site characteristics, household-level heterogeneity, local governance context, and regional economic conditions. The composite regression equation ($\hat{Y} = 0.487 + 0.287X1 + 0.198X2 + 0.234X3 + 0.156X4 + 0.124X5$) provides a quantitative policy planning tool for estimating the welfare impact of targeted improvements in each program implementation dimension.

CONCLUSION

This quantitative study provides statistically rigorous evidence that all five examined dimensions of social forestry program implementation—income contribution, institutional capacity, technical accompaniment, market access, and land tenure security—are significant positive determinants of community welfare outcomes among social forestry permit holders in Indonesia. The multiple regression model explains 59.6% of variance in community welfare (Adjusted $R^2 = 0.596$, $F = 38.421$, $p < 0.001$), confirming that program effectiveness is substantially driven by identifiable and manageable implementation variables rather than fixed ecological or demographic factors beyond policy control.

The rank order of predictor strength—income contribution ($\beta = 0.312$) > technical accompaniment ($\beta = 0.272$) > institutional capacity ($\beta = 0.236$) > market access ($\beta = 0.193$) > land tenure security ($\beta = 0.141$)—provides a data-driven prioritization framework for policy intervention. The two highest-impact variables—income yield and accompaniment quality—are both directly addressable through program design reforms: expanding the forestry revolving fund to increase productive capitalization, institutionalizing multi-year post-licensing accompaniment, and diversifying forest enterprise options to increase per-hectare income yield. The institutional capacity finding underscores the need for sustained governance capacity building as a foundational investment that enables all other program components to function effectively.

For practitioners and policymakers, three actionable priorities emerge from this analysis. First, programs should shift from permit-issuance as completion toward a sustained livelihoods development model with measurable income targets and multi-year support commitments. Second, market integration must be integrated as a core program component, not a supplementary activity, to ensure that productive management translates into competitive income streams. Third, KTH institutional capacity must be built through facilitated, sustained processes rather than one-time training, using peer learning networks and accredited accompaniment partnerships. Future research should investigate welfare outcomes longitudinally to assess the durability of social forestry income gains over time, and examine interaction effects among the five predictors to identify synergistic policy combinations.

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