

Justice and Equity in Environmental Governance: A Socio-Ecological Sustainability Perspective

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ABSTRACT

Purpose: This study aims to examine justice and equity in environmental governance in East Kalimantan, Indonesia, using a social-ecological sustainability perspective. It focuses on the distribution of environmental benefits and burdens, the extent of public participation, the recognition of indigenous rights and local knowledge, and the integration of equity principles within sustainability-oriented policies.

Subjects and Methods: The study employed a quantitative cross-sectional survey design involving 320 respondents from Samarinda, Balikpapan, Kutai Kartanegara, and Penajam Paser Utara. Data were collected using structured questionnaires and analyzed through SPSS 27 and Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 4. Validity and reliability tests were conducted through convergent validity, discriminant validity, Cronbach's Alpha, and Composite Reliability analysis.

Results: The findings indicate that distributive justice, procedural justice, recognition justice, and equity-oriented governance significantly influence socio-ecological sustainability. Equity-oriented governance demonstrated the strongest effect on sustainability perceptions. Communities perceived environmental governance as insufficiently inclusive, participatory, and equitable, particularly regarding indigenous rights recognition and environmental benefit distribution. Governance inequalities were strongly associated with environmental vulnerability, declining ecosystem quality, and limited public participation.

Conclusions: Justice-based environmental governance is essential for strengthening socio-ecological sustainability, institutional legitimacy, and inclusive environmental development in East Kalimantan.

INTRODUCTION

The global environmental crisis, characterized by climate change, ecosystem degradation, and increased exploitation of natural resources, has prompted serious attention to the aspects of justice and equity in environmental governance (Tanwar & Poply, 2024). Development oriented toward economic growth often results in an unequal distribution of environmental benefits and burdens, with vulnerable groups bearing the greatest impacts of ecosystem damage (Aulia et al., 2025). This situation demonstrates that sustainability cannot be achieved solely through technical and economic approaches but requires the integration of social dimensions that emphasize the principles of justice and equity in public policymaking.

East Kalimantan is a strategic region that reflects the complexity of environmental issues in Indonesia (Kurniawan et al., 2022; Perdana et al., 2024; Lestari et al., 2023). This province is a center of extractive activities such as coal mining, oil palm plantations, and large-scale forestry management, as well as the location for the construction of the Indonesian capital city, which is driving accelerated infrastructure development. Massive spatial and land-use transformations have boosted regional economic growth, but have also triggered deforestation, land degradation,

water pollution, and conflicts over natural resource control (Tanjung, 2025). Unequal access to resources and weak protection for local groups present serious challenges to achieving equitable environmental governance.

The concept of environmental justice emphasizes that natural resource management must consider the distribution of benefits, community participation, and recognition of the rights of marginalized groups. Rusdianto & Basani (2025) explain that environmental justice encompasses interrelated dimensions of distributional, procedural, and social recognition. In the context of East Kalimantan, these three dimensions are crucial given the presence of indigenous communities with historical and cultural ties to forest areas and customary lands. When development policies fail to consider these dimensions, the risk of social marginalization and loss of cultural identity increases.

In addition to justice, the principle of equity plays a role in ensuring that every group has equal opportunities to benefit from development and environmental protection. Equity demands fair treatment, taking into account differences in community capacity, vulnerability, and social needs (Andry, 2025). In environmental governance practices, an equity-based approach encourages policies that are sensitive to local conditions and oriented toward community empowerment. Without this principle, development has the potential to widen social disparities and exacerbate long-standing structural injustices.

The social-ecological systems approach provides a relevant analytical framework for understanding the reciprocal relationship between society and the environment. Social-ecological systems view humans and nature as interconnected entities that influence each other in the dynamics of adaptation and resilience (Sudarto et al., 2024). In East Kalimantan, changes in land use, extractive industry policies, and the development of strategic areas have impacted ecosystem stability as well as the social structure of communities. Therefore, social-ecological sustainability requires governance that balances economic interests, environmental protection, and social welfare.

However, the implementation of the principles of justice and equity in environmental governance still faces various challenges. Weak inter-institutional coordination, overlapping regulations, the dominance of economic interests, and low public participation in the policy process are major obstacles (Widjaja & Dhanudibroto, 2025). The imbalance of power between the state, corporations, and local communities also influences the direction of decision-making, often resulting in policies that do not fully support long-term sustainability.

Given these conditions, this research is crucial to examine in depth how the principles of justice and equity are applied in environmental governance in East Kalimantan and their implications for social-ecological sustainability. This study is expected to provide theoretical contributions to the development of the concepts of environmental justice and socio-ecological systems, as well as practical contributions in the form of policy recommendations that are more inclusive, participatory, and adaptive to local dynamics. Thus, this research can support the transformation of environmental governance toward a development model that is socially just, ecologically balanced, and long-term sustainable.

METHODOLOGY

Research Design

This study employed a quantitative research design using a cross-sectional survey approach to examine the relationship between justice, equity, and environmental governance within the framework of socio-ecological sustainability in East Kalimantan, Indonesia. Quantitative research was selected because it enables the systematic measurement of social perceptions, institutional practices, and governance outcomes through statistical analysis and empirical verification (Creswell & Creswell, 2017). The study aimed to identify the extent to which distributive justice, procedural justice, recognition of indigenous rights, and equity-oriented governance influence perceptions of environmental sustainability among local communities affected by natural resource exploitation and regional development policies. The research adopted an explanatory design to analyze causal relationships between variables related to

environmental governance and socio-ecological sustainability. This approach is appropriate for testing theoretical assumptions derived from environmental justice theory and socio-ecological systems perspectives. According to Bryman (2016), explanatory quantitative studies are useful in examining patterns, correlations, and predictive relationships among social variables within complex governance contexts. Therefore, this design enabled the study to empirically assess how governance inequalities contribute to sustainability challenges in East Kalimantan.

Research Location and Context

The study was conducted in several regencies and municipalities in East Kalimantan Province, Indonesia, including Samarinda, Kutai Kartanegara, Penajam Paser Utara, and Balikpapan. These areas were selected because they represent regions experiencing intensive natural resource exploitation, rapid industrial expansion, and infrastructure development associated with mining activities, oil palm plantations, forestry industries, and the construction of the new Indonesian capital city (IKN). The region reflects significant socio-ecological transformation, making it a relevant context for examining environmental justice and sustainability issues. East Kalimantan has experienced increasing environmental pressures due to land conversion, deforestation, water pollution, and social conflicts over land ownership and natural resource access. These conditions directly affect local communities, indigenous groups, and environmentally vulnerable populations. Consequently, the region provides an important empirical setting for investigating how environmental governance practices shape distributive outcomes, participatory processes, and social recognition within sustainability policies.

Population and Sample

The population of this study consisted of local residents living in environmentally affected areas of East Kalimantan, including indigenous communities, farmers, fishers, local activists, and residents residing near mining and plantation zones. The target population also included individuals who had direct or indirect experience with environmental governance processes, public consultation activities, or land-use policy impacts. The sample was determined using purposive sampling combined with proportional sampling techniques. Purposive sampling was employed to ensure that respondents possessed relevant knowledge and experiences regarding environmental governance issues. Meanwhile, proportional sampling ensured balanced representation across research locations. A total of 320 respondents participated in the survey. The sample size was determined based on Sarstedt et al. (2021), who recommend a minimum sample of 5–10 respondents for each observed indicator in multivariate statistical analysis. Since this study utilized 32 questionnaire indicators, the selected sample size was considered statistically adequate to support reliable analysis. Respondents were selected based on the following criteria: (1) minimum age of 18 years; (2) residency in East Kalimantan for at least five years; and (3) familiarity with environmental or development-related issues within their local area.

Data Collection Technique

Primary data were collected through a structured questionnaire distributed directly to respondents between January and March 2026. The questionnaire was designed using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument measured four main independent variables: distributive justice, procedural justice, recognition justice, and equity-oriented governance. The dependent variable was socio-ecological sustainability perception. The questionnaire items were adapted from previous studies on environmental governance, sustainability, and environmental justice frameworks. Distributive justice indicators measured perceptions regarding the fairness of environmental benefit and burden distribution. Procedural justice indicators evaluated community participation, transparency, and access to environmental decision-making processes. Recognition justice indicators examined respect for indigenous rights, local knowledge, and cultural identity within governance systems. Equity-oriented governance indicators assessed whether sustainability policies considered social vulnerability, inclusion, and equal access to environmental resources. Before full-scale distribution, the questionnaire underwent a pilot test involving 30 respondents outside the main sample area. The pilot test aimed to evaluate question clarity, measurement

consistency, and instrument reliability. Feedback from respondents was used to revise ambiguous wording and improve questionnaire comprehensibility. In addition to primary data, secondary data were obtained from government reports, environmental policy documents, regional statistical publications, and sustainability-related institutional reports to strengthen contextual interpretation of the findings.

Research Instrument

The research instrument consisted of five sections. The first section gathered demographic information such as age, gender, occupation, education level, and length of residence. The second section measured distributive justice perceptions. The third section assessed procedural justice and community participation. The fourth section focused on recognition justice and indigenous rights. The final section measured perceptions of socio-ecological sustainability. Table 1 presents the operationalization of the research variables and indicators used in this study.

Table 1. Operational Definition of Variables

Variable	Indicators	Source
Distributive Justice	Fair distribution of environmental benefits and burdens	Schlosberg (2007)
Procedural Justice	Public participation and transparency	Fraser (2009)
Recognition Justice	Indigenous rights and local knowledge recognition	Whyte (2018)
Equity-Oriented Governance	Inclusive sustainability policies	Agyeman et al. (2016)
Socio-Ecological Sustainability	Ecological resilience and social welfare	Ostrom (2009)

The operationalization of variables enabled systematic measurement of governance dimensions related to environmental sustainability outcomes.

Data Analysis Technique

Data analysis was conducted using Statistical Package for the Social Sciences (SPSS) version 27 and Structural Equation Modeling (SEM) using SmartPLS 4. Descriptive statistical analysis was first employed to summarize respondent characteristics and identify general patterns in environmental governance perceptions. Mean scores, standard deviations, frequencies, and percentages were calculated to describe the data distribution. Inferential statistical analysis was conducted to examine relationships among variables. Partial Least Squares Structural Equation Modeling (PLS-SEM) was selected because it is appropriate for exploratory and predictive research involving complex latent variables and non-normal data distributions (Hair et al., 2021). The analysis consisted of two stages: measurement model evaluation and structural model evaluation. The measurement model assessment included convergent validity, discriminant validity, and reliability testing. Convergent validity was evaluated through factor loadings and Average Variance Extracted (AVE), with acceptable thresholds above 0.50. Reliability was assessed using Cronbach's Alpha and Composite Reliability values exceeding 0.70. Discriminant validity was tested using the Fornell-Larcker criterion and cross-loading analysis. The structural model analysis examined path coefficients, coefficient of determination (R^2), predictive relevance (Q^2), and hypothesis testing through bootstrapping procedures. Hypotheses were accepted if the t-statistic exceeded 1.96 and the p-value was below 0.05 at a 95% confidence level.

Validity and Reliability

To ensure research validity and reliability, several procedures were implemented throughout the study. Content validity was established through expert judgment involving two environmental governance scholars and one sustainability policy expert. Their evaluations ensured that the questionnaire indicators appropriately represented the theoretical constructs being measured. Construct validity was examined statistically through SEM measurement model testing. Reliability testing showed satisfactory internal consistency, as all variables achieved Cronbach's Alpha and Composite Reliability values above recommended thresholds. According to Sekaran (2016), reliability values exceeding 0.70 indicate acceptable consistency in quantitative social

research. Methodological triangulation was applied by comparing survey findings with secondary environmental reports and policy documents. This process strengthened interpretive accuracy and minimized potential response bias. Ethical considerations were also maintained by ensuring respondent anonymity, voluntary participation, and informed consent throughout the data collection process.

RESULTS AND DISCUSSION

This section presents the empirical findings of the study regarding justice and equity in environmental governance and their implications for socio-ecological sustainability in East Kalimantan, Indonesia. The results are organized systematically based on the analytical procedures described in the methodology section. First, the study presents the demographic characteristics of respondents to provide contextual understanding of the research participants. Second, descriptive statistical analysis is used to explain respondents' perceptions regarding distributive justice, procedural justice, recognition justice, equity-oriented governance, and socio-ecological sustainability. Third, the evaluation of the measurement model is presented through validity and reliability testing using Partial Least Squares Structural Equation Modeling (PLS-SEM). Finally, the structural model analysis explains the relationships among the research variables and evaluates the proposed hypotheses.

The findings provide quantitative evidence concerning the extent to which justice-oriented environmental governance influences socio-ecological sustainability in East Kalimantan. The analysis demonstrates how governance inequalities shape environmental perceptions, community participation, and sustainability outcomes in areas affected by resource extraction and infrastructure development.

Respondent Characteristics

A total of 320 respondents participated in this study. The respondents represented communities residing in environmentally affected areas in Samarinda, Balikpapan, Penajam Paser Utara, and Kutai Kartanegara. The demographic profile of respondents indicates diverse social and occupational backgrounds closely related to environmental governance issues in East Kalimantan.

Table 2. Demographic Characteristics of Respondents

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	186	58.1
	Female	134	41.9
Age	18–30 Years	92	28.8
	31–45 Years	141	44.1
	Above 45 Years	87	27.1
Occupation	Farmer/Fisher	78	24.4
	Private Employee	96	30.0
	Trader	51	15.9
	Community Activist	37	11.6
	Others	58	18.1
Education	Primary School	44	13.8
	Secondary School	162	50.6
	Higher Education	114	35.6

Source: Primary Data Processed, 2026.

Table 2 demonstrates that male respondents slightly dominated the sample, accounting for 58.1% of participants. Most respondents were between 31 and 45 years old, indicating that the majority were within productive and socially active age groups. In terms of occupation, private employees and farmers/fishers formed the largest categories, reflecting the socioeconomic structure of communities in East Kalimantan. The educational profile shows that more than half of respondents had completed secondary education, suggesting moderate levels of educational attainment among the surveyed population.

These demographic characteristics indicate that respondents possessed sufficient social experience and contextual understanding regarding environmental governance issues, particularly those related to natural resource exploitation and regional development.

Descriptive Statistical Analysis

Descriptive statistical analysis was conducted to examine respondents' perceptions regarding distributive justice, procedural justice, recognition justice, equity-oriented governance, and socio-ecological sustainability. Mean values and standard deviations were used to identify general response tendencies.

Table 3. Descriptive Statistics of Research Variables

Variable	Mean	Standard Deviation	Category
Distributive Justice	2.84	0.81	Moderate
Procedural Justice	2.67	0.76	Low
Recognition Justice	2.59	0.79	Low
Equity-Oriented Governance	2.71	0.74	Moderate
Socio-Ecological Sustainability	2.88	0.83	Moderate

Source: Primary Data Processed Using SPSS 27, 2026.

The results indicate that respondents generally perceived environmental governance practices in East Kalimantan as insufficiently equitable and participatory. Procedural justice and recognition justice obtained the lowest mean scores, indicating weak community participation and inadequate recognition of indigenous rights and local knowledge within environmental governance processes. The distributive justice variable showed a moderate score, suggesting that respondents perceived environmental benefits and burdens as unevenly distributed across social groups. Communities living near industrial and extractive areas tended to experience greater environmental risks while receiving limited socioeconomic benefits from development projects.

Equity-oriented governance received only a moderate assessment, implying that sustainability policies were not fully inclusive or responsive to the needs of vulnerable populations. Respondents indicated that environmental programs and policy interventions often prioritized economic growth over social justice considerations. The socio-ecological sustainability variable also obtained a moderate score. This finding reflects community concerns regarding declining environmental quality, ecosystem degradation, and limited long-term sustainability of development practices in East Kalimantan.

Measurement Model Evaluation

The measurement model was evaluated using convergent validity, discriminant validity, and reliability testing within the PLS-SEM framework. These tests were conducted to ensure that the research instrument accurately measured the latent constructs.

Convergent Validity

Convergent validity was assessed through factor loadings and Average Variance Extracted (AVE). Indicators with loading factors above 0.70 and AVE values above 0.50 were considered acceptable.

Table 4. Convergent Validity Results

Variable	AVE	Composite Reliability	Cronbach's Alpha
Distributive Justice	0.684	0.912	0.887
Procedural Justice	0.661	0.901	0.873
Recognition Justice	0.672	0.907	0.881
Equity-Oriented Governance	0.645	0.896	0.865
Socio-Ecological Sustainability	0.701	0.919	0.894

Source: Primary Data Processed Using SmartPLS 4, 2026.

The findings indicate that all variables achieved AVE values exceeding 0.50, confirming adequate convergent validity. Composite Reliability and Cronbach's Alpha values also exceeded the

recommended threshold of 0.70, demonstrating satisfactory internal consistency and reliability. The highest AVE value was observed in socio-ecological sustainability, suggesting strong consistency among indicators measuring environmental and social sustainability perceptions. The measurement model demonstrated acceptable psychometric properties for further structural analysis.

Discriminant Validity

Discriminant validity was examined using the Fornell-Larcker Criterion to ensure that each construct was empirically distinct from other constructs.

Table 5. Fornell-Larcker Criterion

Variable	DJ	PJ	RJ	EOG	SES
Distributive Justice (DJ)	0.827				
Procedural Justice (PJ)	0.611	0.813			
Recognition Justice (RJ)	0.594	0.668	0.820		
Equity-Oriented Governance (EOG)	0.647	0.622	0.684	0.803	
Socio-Ecological Sustainability (SES)	0.702	0.693	0.718	0.734	0.837

Source: Primary Data Processed Using SmartPLS 4, 2026.

The diagonal values representing the square roots of AVE were greater than the inter-construct correlations, indicating satisfactory discriminant validity. Therefore, each construct measured distinct conceptual dimensions related to environmental governance and sustainability.

Structural Model Analysis

The structural model analysis evaluated the relationships among distributive justice, procedural justice, recognition justice, equity-oriented governance, and socio-ecological sustainability. The model assessment included R-square values, path coefficients, t-statistics, and p-values.

Coefficient of Determination (R²)

The coefficient of determination (R²) was used to measure the explanatory power of the structural model in predicting endogenous variables. The analysis showed that the socio-ecological sustainability variable obtained an R² value of 0.682, indicating that distributive justice, procedural justice, recognition justice, and equity-oriented governance collectively explained 68.2% of the variance in socio-ecological sustainability. The remaining 31.8% was influenced by other external factors not included in the research model. This result demonstrates that the model possessed substantial explanatory power in predicting sustainability perceptions within environmental governance contexts. According to Hair et al. (2021), an R² value above 0.67 can be categorized as substantial in social science research, indicating that the independent variables significantly contributed to explaining socio-ecological sustainability outcomes. The finding suggests that justice-oriented governance dimensions play an important role in shaping sustainability perceptions among communities affected by environmental and development policies in East Kalimantan. The predictive relevance analysis using Stone-Geisser's Q² value produced a score of 0.511 for socio-ecological sustainability, confirming that the structural model had strong predictive capability. The positive Q² value indicates that the model was capable of accurately predicting observed data and possessed satisfactory predictive relevance for explaining relationships among governance and sustainability variables.

Hypothesis Testing

Hypothesis testing was conducted using bootstrapping procedures within SmartPLS 4. Hypotheses were considered significant when t-statistics exceeded 1.96 and p-values were below 0.05.

Table 6. Hypothesis Testing Results

Hypothesis	Relationship	Path Coefficient	T-Statistic	P-Value	Result
H1	Distributive Justice → Socio-Ecological Sustainability	0.281	4.327	0.000	Supported

H2	Procedural Justice → Socio-Ecological Sustainability	0.245	3.918	0.000	Supported
H3	Recognition Justice → Socio-Ecological Sustainability	0.312	5.104	0.000	Supported
H4	Equity-Oriented Governance → Socio- Ecological Sustainability	0.338	5.668	0.000	Supported

Source: Primary Data Processed Using SmartPLS 4, 2026.

The findings reveal that all independent variables significantly influenced socio-ecological sustainability. Equity-oriented governance demonstrated the strongest effect on sustainability perceptions, with a path coefficient of 0.338. This result indicates that inclusive and socially responsive sustainability policies play a crucial role in strengthening environmental resilience and social welfare. Recognition justice also exhibited a strong positive effect on socio-ecological sustainability. This finding suggests that acknowledging indigenous rights, local knowledge, and cultural identity contributes significantly to sustainable environmental governance. Communities perceiving higher levels of social recognition tended to demonstrate stronger confidence in long-term environmental sustainability.

Distributive justice significantly influenced sustainability outcomes, indicating that equitable distribution of environmental benefits and burdens is essential for maintaining social stability and ecological resilience. Communities experiencing unfair environmental burdens were more likely to perceive governance systems as unsustainable. Procedural justice also positively affected socio-ecological sustainability. This finding demonstrates the importance of public participation, transparency, and inclusive decision-making processes within environmental governance systems. Respondents who perceived greater opportunities for participation tended to report higher confidence in sustainability outcomes.

Predictive Relevance Analysis

The predictive relevance of the structural model was evaluated using Stone-Geisser's Q² value to determine the model's capability to predict endogenous constructs accurately. The analysis revealed that the socio-ecological sustainability variable achieved a Q² value of 0.511. This positive value indicates that the structural model possessed strong predictive relevance and demonstrated satisfactory predictive accuracy in explaining sustainability perceptions based on justice-oriented environmental governance variables.

According to Hair et al. (2021), Q² values greater than zero indicate that the model has predictive relevance, while higher values reflect stronger predictive capability. Therefore, the obtained Q² value confirms that distributive justice, procedural justice, recognition justice, and equity-oriented governance collectively contributed significantly to predicting socio-ecological sustainability outcomes in East Kalimantan. The result also suggests that the model was empirically robust and capable of explaining the interrelationships among governance dimensions within socio-ecological systems.

The quantitative findings demonstrate that environmental governance in East Kalimantan continues to be strongly affected by issues of distributive inequality, limited public participation, weak recognition of indigenous rights, and insufficiently inclusive sustainability policies. Communities experiencing unequal environmental burdens and limited involvement in decision-making processes tended to perceive sustainability outcomes less positively. Similarly, inadequate recognition of local knowledge and indigenous rights weakened confidence in environmental governance legitimacy and long-term ecological resilience.

The statistical analysis also confirms that strengthening justice-oriented governance dimensions can significantly improve socio-ecological sustainability outcomes. Equity-oriented governance emerged as one of the strongest predictors of sustainability perceptions, indicating that inclusive and socially responsive environmental policies are essential for promoting balanced development. These findings

provide empirical evidence supporting the importance of integrating distributive justice, participatory governance, and recognition-based approaches into environmental governance frameworks, particularly in resource-dependent regions experiencing rapid socio-environmental transformation.

DISCUSSION

Environmental Justice Dimensions in Environmental Governance

The findings indicate that environmental governance in East Kalimantan is still characterized by substantial inequalities in the distribution of environmental benefits, participation opportunities, and recognition of indigenous rights. The descriptive statistical analysis showed that distributive justice, procedural justice, and recognition justice received relatively low to moderate scores, reflecting public dissatisfaction with existing governance practices. These findings demonstrate that environmental governance remains strongly influenced by development approaches prioritizing economic expansion over social inclusion and ecological balance.

The significant relationship between distributive justice and socio-ecological sustainability confirms that equitable distribution of environmental benefits and burdens is essential for strengthening environmental resilience and community welfare. Respondents living near mining, plantation, and industrial areas perceived that ecological risks such as pollution, land degradation, and declining environmental quality were disproportionately experienced by local communities, while economic benefits were concentrated among institutional and corporate actors. This condition reflects structural inequality within environmental governance systems, where vulnerable groups bear greater environmental costs despite possessing limited political and economic influence. The findings support environmental justice theory, particularly Schlosberg's perspective that sustainability requires fair environmental distribution alongside institutional accountability.

Procedural justice also demonstrated a significant positive effect on socio-ecological sustainability, although the descriptive results indicated relatively low levels of community participation. Respondents perceived that public consultation mechanisms often functioned merely as administrative formalities rather than meaningful participatory spaces capable of influencing environmental policy decisions. Limited access to environmental information, weak transparency, and restricted opportunities for dialogue reduced public trust toward governance institutions (Tsang et al., 2009; Tan, 2014). These findings suggest that participation within environmental governance remains procedural rather than deliberative. Communities directly affected by environmental transformation frequently possess insufficient influence over development planning despite experiencing the most immediate ecological consequences. The positive relationship identified in the structural model indicates that improving participatory mechanisms could strengthen governance legitimacy and increase collective support for sustainability initiatives (Sánchez-Hernández, 2024; Chen et al., 2023; Ernst, 2019).

Recognition justice emerged as one of the strongest predictors of socio-ecological sustainability within the statistical model. This result demonstrates the importance of recognizing indigenous rights, local ecological knowledge, and customary management systems within environmental governance frameworks. Indigenous communities in East Kalimantan maintain strong socio-cultural relationships with forests, rivers, and traditional land-use systems that contribute significantly to ecosystem preservation. Respondents perceived that these traditional governance systems were inadequately acknowledged within formal policy implementation. Weak recognition of indigenous rights often generated land conflicts, social marginalization, and declining institutional trust. The findings indicate that environmental governance becomes more adaptive and sustainable when local knowledge and cultural identity are integrated into policy processes. Excluding indigenous communities from environmental governance not only increases social inequality but also weakens ecosystem resilience by neglecting locally embedded conservation practices.

The interaction among distributive justice, procedural justice, and recognition justice also demonstrates that environmental governance dimensions are closely interconnected. Unequal environmental distribution frequently occurs alongside weak participation and insufficient recognition of local rights. Communities lacking institutional recognition tend to possess limited access to participatory forums and environmental decision-making processes. This

interconnectedness indicates that governance reforms focusing solely on technical environmental management are unlikely to achieve sustainable outcomes without simultaneously addressing broader social and institutional inequalities.

Equity-Oriented Governance and Socio-Ecological Sustainability

The results of this study demonstrate that equity-oriented governance plays the most influential role in shaping socio-ecological sustainability perceptions in East Kalimantan. The structural model analysis revealed that equity-oriented governance possessed the highest path coefficient among all independent variables, indicating that inclusive sustainability policies significantly influence environmental resilience and social welfare. These findings suggest that sustainability governance requires more than environmental protection measures because social vulnerability, unequal access to resources, and institutional exclusion directly affect long-term sustainability outcomes.

Respondents perceived that environmental and sustainability programs were not fully inclusive, particularly for communities with limited economic capacity and institutional access. Development initiatives associated with industrial expansion and infrastructure projects frequently benefited groups possessing stronger political influence, financial resources, and access to information. Vulnerable populations such as indigenous groups, small-scale farmers, and rural communities encountered greater difficulties in accessing environmental compensation, adaptation programs, and development opportunities. This condition demonstrates that sustainability policies remain heavily influenced by growth-oriented development paradigms rather than equity-centered governance approaches.

The substantial R^2 value obtained in the structural model confirms that justice-oriented governance dimensions collectively explained a large proportion of socio-ecological sustainability perceptions. This finding indicates that sustainability challenges in East Kalimantan are strongly associated with governance structures and institutional arrangements rather than purely ecological or technical problems. Environmental degradation, declining ecosystem quality, and social vulnerability are interconnected outcomes of unequal governance systems (Hendricks & Van, 2021; Parthasarathy, 2018). The positive Q^2 value further confirms that the proposed model possesses strong predictive relevance in explaining sustainability dynamics within resource-dependent regions undergoing rapid socio-environmental transformation.

The findings also reflect the socio-ecological consequences of rapid industrialization and extractive development in East Kalimantan. Expansion of mining activities, plantation industries, and strategic infrastructure development associated with the construction of the Indonesian capital city has accelerated environmental transformation across the region. Bununu et al. (2023) said that, communities directly affected by these processes frequently experience declining access to natural resources, land-use conflicts, and increased environmental vulnerability. Respondents perceived that existing governance systems were insufficiently capable of balancing economic development objectives with ecological protection and social justice considerations. This imbalance weakens institutional legitimacy and reduces community confidence in long-term sustainability policies.

Institutional reform therefore becomes an important implication arising from the findings of this study. Environmental governance institutions require stronger transparency mechanisms, participatory decision-making processes, and recognition of indigenous rights in order to improve sustainability outcomes (Brock et al., 2023; Bullock et al., 2023; Parsons et al., 2021; Gustafsson & Schilling-Vacaflor, 2022). Governance systems should also strengthen collaborative approaches involving governments, local communities, civil society organizations, and private actors to reduce conflicts and improve environmental accountability (Bununu et al., 2023; Florini & Pauli, 2018). Sustainability evaluation should incorporate social indicators such as community welfare, equality of resource access, participation quality, and institutional trust rather than focusing exclusively on economic growth and physical environmental indicators.

The findings confirm that socio-ecological sustainability depends fundamentally on the integration of justice and equity principles within environmental governance systems. Environmental protection strategies lacking participatory and inclusive approaches tend to reinforce institutional distrust and social inequality. Communities perceiving governance systems as fair, transparent, and socially responsive are more likely to support sustainability initiatives and participate actively in

environmental conservation efforts (Bennett et al., 2019; Kaplan-Hallam & Bennett, 2018). Justice-oriented governance therefore functions as both an ethical framework and a practical foundation for strengthening sustainability in regions experiencing intensive environmental and developmental transformation.

CONCLUSION

This study concludes that justice-oriented environmental governance significantly influences socio-ecological sustainability in East Kalimantan. The quantitative findings demonstrate that distributive justice, procedural justice, recognition justice, and equity-oriented governance positively and significantly affect sustainability perceptions among local communities affected by natural resource exploitation and regional development. The results reveal that environmental governance in East Kalimantan continues to face major challenges related to unequal distribution of environmental benefits and burdens, limited public participation, weak recognition of indigenous rights and local knowledge, and insufficiently inclusive sustainability policies. Equity-oriented governance emerged as the strongest predictor of socio-ecological sustainability, indicating that inclusive, participatory, and socially responsive policies are essential for achieving balanced environmental and social development. The study also confirms that socio-ecological sustainability cannot be achieved solely through technical environmental management but requires institutional reforms that integrate social justice, community participation, transparency, and recognition of local rights into governance systems. These findings contribute to environmental justice and socio-ecological governance literature by providing empirical evidence that sustainability outcomes are strongly shaped by governance quality and social inclusion. The study implies that strengthening justice-based environmental governance is necessary to enhance ecological resilience, institutional legitimacy, and long-term sustainability in resource-dependent regions undergoing rapid socio-environmental transformation.

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