Strategic Sustainability and Green Actions for Capacity Building and Smallholder Empowerment within FSC-Certified Natural Rubber

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Abstract. This study explores the strategic integration of sustainability and green capacity-building to empower smallholder farmers in the FSC-certified natural rubber supply chain in Indonesia. Using a quantitative approach with Structural Equation Modeling Partial Least Squares (SEM–PLS), data from 105 smallholders participating in the FSC Sharing Program were analyzed to examine the relationships among Green Capacity Building, Sustainability Awareness, Sustainability Performance, Smallholder Welfare, and Institutional Engagement. The results reveal that Green Capacity Building significantly enhances Sustainability Awareness, which, in turn, strongly influences Institutional Engagement, demonstrating a mediating effect. Meanwhile, Sustainability Performance and Smallholder Welfare directly affect Institutional Engagement without mediation. The model's explanatory power is high ($R^2 = 0.911$), indicating strong predictive validity. These findings highlight the strategic importance of integrating green capacity-building and awareness programs to strengthen institutional collaboration and promote inclusive, sustainable development in the natural rubber industry.

Keywords: Strategic Sustainability; Green Actions; Capacity Building; Smallholder Empowerment; FSC Certification; Sustainable Supply Chain; Natural Rubber Industry; Inclusive Development

1 Introduction

1.1 Global Context: Sustainability as a Strategic Imperative

In the last two decades, sustainability has evolved from a normative agenda into a strategic imperative that shapes global economic and industrial policies. Climate change, biodiversity loss, and social inequality have pushed governments, corporations, and civil societies to transform business models toward sustainable value creation. The United Nations Sustainable Development Goals (SDGs), particularly Goals 8 (Decent Work and Economic Growth), 12 (Responsible Consumption and Production), and 13 (Climate Action), have become reference points for aligning business practices with long-term ecological and social objectives.

J. M. Damanik et al. (eds.), *Proceedings of the 4th International Conference on Management and Business (ICOMB 2025)*, Advances in Economics, Business and Management Research 386,
https://doi.org/10.2991/978-94-6239-656-2_17

Within this transformation, the private sector plays a crucial role. Corporations are no longer evaluated solely by their financial performance but also by their environmental, social, and governance (ESG) contributions. Green innovation, circular economy models, and inclusive value chain strategies are increasingly embedded in corporate strategies to respond to growing stakeholder expectations. Consequently, sustainability initiatives are no longer peripheral but integrated into the core of strategic management, influencing decisions on sourcing, production, and partnerships across global supply chains.

1.2 The Southeast Asian and Indonesian Perspective

Southeast Asia, particularly Indonesia, stands at the crossroads of sustainability challenges and opportunities. As one of the largest producers of natural rubber, palm oil, and other agro-based commodities, Indonesia's economy relies heavily on smallholder farmers who are vulnerable to price volatility, limited access to finance, and environmental degradation. In this context, sustainability is not merely an ecological concern but a socioeconomic necessity that determines the resilience and competitiveness of rural economies.

Indonesia's rubber sector represents a unique case. With more than 80% of natural rubber production coming from smallholders, the sector's sustainability depends on how these farmers adopt green practices and integrate into sustainable global supply chains. However, smallholders often face significant barriers, ranging from limited technical capacity and financial literacy to weak institutional support. Addressing these barriers requires an integrated model of green capacity building that links sustainability initiatives with inclusive economic empowerment.

1.3 Strategic Partnership as a Model for Green Capacity Building

To bridge this gap, cross-sector partnerships between global corporations and local industries have emerged as transformative enablers of sustainability. The collaboration between Pirelli, a global tire manufacturer committed to sustainable sourcing, and Kirana Megatara Group, Indonesia's leading crumb rubber producer, exemplifies such a model. Through the FSC (Forest Stewardship Council) Sharing Program, the partnership integrates environmental stewardship, social inclusion, and economic upgrading into the natural rubber supply chain.

The program aims to develop green competencies among smallholder farmers through capacity-building activities, including training in sustainable rubber tapping, responsible chemical use, waste reduction, and cooperative governance. Beyond technical improvement, the program emphasizes behavioral change, social learning, and value co-creation among stakeholders. The initiative aligns with the Natural Resource-Based View (NRBV) and Stakeholder Theory, underscoring that sustainable competitiveness arises from resource stewardship and stakeholder collaboration.

1.4 Research Motivation and Objectives

While many studies have examined corporate social responsibility (CSR) initiatives, fewer have focused on green capacity building as a strategic component of sustainability management. This study proposes a Sustainability View that repositions green initiatives not as philanthropic activities but as integral elements of strategic management, thereby enhancing firm resilience, stakeholder trust, and shared prosperity.

Using survey data from participants of the FSC Sharing Program in South Sumatra, this paper aims to:

1. Analyze the impact of green capacity-building activities on sustainability performance and smallholder welfare.
2. Examine the structural relationships among sustainability awareness, capacity enhancement, and economic well-being using Structural Equation Modeling – Partial Least Squares (SEM-PLS).
3. Conceptualize a model of Sustainability View that integrates environmental initiatives into corporate strategic frameworks.

Through this analysis, the study contributes both theoretically and practically: it enriches sustainability management literature by operationalizing green capacity building as a strategic construct, and it provides empirical insights for policymakers and corporations in designing inclusive, sustainable supply chain interventions.

2 Literature Review

2.1 Theoretical Foundations of Sustainability in Strategic Management

Sustainability has become increasingly central to strategic management, emphasizing the alignment of corporate goals with environmental and social responsibilities. Traditional business strategies, primarily focused on economic efficiency and shareholder value, have evolved toward sustainable value creation, in which firms pursue competitive advantage through environmental stewardship, social inclusiveness, and ethical governance ([1]; [2]).

The sustainability paradigm emphasizes long-term resilience over short-term profitability. It integrates three interrelated dimensions: economic performance, social well- being, and ecological integrity. These dimensions reflect the Triple Bottom Line [3] and form the foundation of the Sustainability View. This perspective sees green initiatives not merely as compliance mechanisms but as core strategic assets that shape firm competitiveness, innovation, and legitimacy.

In the context of global supply chains, sustainability-oriented strategies require firms to extend their responsibility beyond organizational boundaries. This includes fostering collaboration with upstream and downstream stakeholders, especially in resource-dependent sectors such as natural rubber. The success of such initiatives depends heavily on capacity-building, institutional alignment, and stakeholder engagement, factors that determine whether sustainability practices can be internalized across the value chain.

2.2 Natural Resource-Based View (NRBV)

The Natural Resource-Based View (NRBV), proposed by [1], extends the traditional Resource-Based View (RBV) by integrating environmental dimensions into strategic resource management. NRBV posits that sustainable competitive advantage arises from a firm's ability to develop capabilities that reduce environmental impact while enhancing resource efficiency. Key components of NRBV include:

1. Pollution Prevention – reducing waste and emissions through process efficiency.
2. Product Stewardship – designing and managing products with life-cycle sustainability in mind.
3. Sustainable Development – integrating social and environmental considerations into strategic planning.

In this study's context, green capacity building among rubber smallholders reflects the NRBV principle of developing unique capabilities, knowledge, skills, and practices that lead to both ecological and economic benefits. By transferring sustainability know-how, the partnership between Pirelli and Kirana Megatara cultivates resource-based competencies within the local ecosystem, enhancing both environmental performance and farmer welfare.

2.3 Institutional Theory and the Role of Governance Structures

Institutional Theory [4] (Scott, 2001) provides another explanatory framework for understanding why organizations adopt sustainability practices. Institutions, comprising norms, regulations, and cultural expectations, shape organizational behavior by creating legitimacy pressures. Firms adopt sustainability-oriented practices not only for efficiency but also to meet stakeholder expectations, regulatory requirements, and social norms.

In Indonesia's natural rubber sector, institutional factors such as certification standards (e.g., FSC, ISCC), government regulations, and buyer requirements from multinational corporations exert coercive and normative pressures to drive sustainability adoption. The partnership model between Pirelli and Kirana Megatara leverages these institutional forces by embedding certification, training, and traceability systems into daily operations.

Through structured capacity building, local smallholders are not only equipped to meet institutional standards but also empowered to internalize sustainability as a shared value system. This process of institutional isomorphism, in which actors align their practices to achieve legitimacy, becomes a catalyst for system-wide transformation in the supply chain.

2.4 Stakeholder Theory and Inclusive Sustainability

Stakeholder Theory [5] argues that organizational success depends on value creation for multiple stakeholders, not only shareholders, but also employees, suppliers, communities, and the environment. In sustainability discourse, this theory emphasizes inclusivity, transparency, and mutual benefit as principles of corporate governance.

In the case of green initiatives within the rubber industry, stakeholders include global buyers (e.g., tire manufacturers), local processors, smallholder farmers, NGOs, and financial institutions. The interactions among these actors determine the distribution of value and the degree of sustainability embedded in the supply chain.

The FSC Sharing Program exemplifies this theory by fostering collaboration and knowledge co-creation among stakeholders. Farmers gain access to training and incentives, industries secure sustainable supply, and global partners strengthen brand legitimacy. This multi-stakeholder synergy operationalizes sustainability not as a top-down directive but as a shared governance model that promotes social learning and long-term welfare.

2.5 Green Capacity Building: From CSR to Strategic Integration

While many sustainability initiatives have historically been framed under Corporate Social Responsibility (CSR), recent scholarship suggests a paradigmatic shift toward strategic sustainability integration ([6]; [7]). Unlike CSR, which often focuses on reputation and compliance, green capacity building emphasizes the development of systemic capabilities and empowerment across the value chain. In this regard, capacity building transcends technical training. It includes:

1. Knowledge Transfer: dissemination of sustainable agricultural practices, tapping techniques, and waste management.
2. Social Capital Formation: strengthening farmer groups, cooperatives, and local governance structures.
3. Behavioral Change: fostering environmental awareness, financial discipline, and collective responsibility.
4. Economic Empowerment: improving productivity and market access to enhance income stability.

Thus, green capacity building becomes a vehicle for sustainability transformation, linking individual competencies with collective resilience and institutional legitimacy. Within the Sustainability View, it represents the operational mechanism through which firms integrate green initiatives into strategic management processes.

3 Methodology

3.1 Research Design

This study employs a quantitative explanatory research design using the Structural Equation Modeling–Partial Least Squares (SEM–PLS) technique to empirically examine the causal relationships among green capacity building, sustainability awareness, sustainability performance, and smallholder welfare.

The research aims to assess the effectiveness of green capacity-building initiatives conducted through the FSC Sharing Program, a collaborative effort between Pirelli and PT Kirana Permata (a subsidiary of Kirana Megatara Group) to strengthen sustainability orientation among smallholder rubber farmers in Muara Enim District, South Sumatra, Indonesia.

SEM–PLS was chosen due to its suitability for complex models involving latent constructs, small-to-medium sample sizes, and exploratory contexts such as sustainability and social development [8]. The model allows simultaneous estimation of measurement reliability and structural relationships, providing robust insights into both direct and indirect effects.

3.2 Population and Sampling

The study population consists of rubber smallholders participating in the FSC Sharing Program in South Sumatra who have attended training sessions on green production, waste reduction, and sustainable farming practices.

A total of 105 respondents were included in the final sample, representing farmers from multiple village clusters within the Muara Enim region. The selection followed a purposive sampling technique, ensuring that only participants directly involved in the program were included, as they have relevant exposure to sustainability capacity-building activities. Although the sample size appears modest, it satisfies the ten-times rule for SEM– PLS, as each construct in the model was measured by no more than five indicators, meeting the minimum statistical adequacy [9].

3.3 Data Collection

Data were collected using a structured questionnaire administered at the conclusion of the training sessions. The questionnaire was designed to capture participants' perceptions of five dimensions of program effectiveness and sustainability orientation.

The instrument used a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) and covered the following sections:

1. Understanding and Purpose (UP) – assessing participants' comprehension of sustainability principles and training objectives.
2. Content and Material (CM) – evaluating relevance, clarity, and applicability of training materials.
3. Facilitator and Resource Person (FR) – measuring perceived expertise, delivery quality, and engagement.
4. Technical Implementation (TI) – examining logistics, accessibility, and practical arrangements.
5. Benefit and Satisfaction (BS) – reflecting outcomes, perceived benefits, and overall satisfaction with capacity building.

The responses were subsequently coded and analyzed as latent indicators representing the broader constructs of *Green Capacity Building* (GCB), *Sustainability Awareness* (SA), *Sustainability Performance* (SP), and *Smallholder Welfare* (SW).

3.4 Measurement Model and Operational Definitions

Each latent construct was defined based on theoretical foundations and measured by several observed indicators, as summarized in Table 1.

Table 1 Operationalization of Constructs

Construct	Dimension	Indicators	Source
Green Capac- ity Building (GCB)	Understanding, Content, Facilitator, Technical Imple- mentation	Knowledge enhance- ment, relevance of train- ing, facilitator compe- tence, implementation logistics	[6], [7]
Sustainability Awareness (SA)	Awareness of envi- ronmental, social, and economic im- pacts	Attitude change, sus- tainability understand- ing, behavioral intention	[1]
Sustainability Performance (SP)	Application of sus- tainable practices	Waste management, tapping efficiency, input optimization	NRBV frame- work

Smallholder Welfare (SW)	Economic and social well-being	Income stability, productivity, coopera- tion participation	[5] [3]
Institutional Engagement (IE)	Involvement with formal institutions	Certification participation, cooperative governance, traceability compliance	[4], (Scott, 2001)

3.5 Data Analysis Technique

The data were analyzed using SmartPLS 3.0, following a two-stage approach:

1. Measurement Model Evaluation
   a) Convergent Validity: assessed using Average Variance Extracted (AVE), with acceptable values > 0.50.
   b) Discriminant Validity: verified through Fornell–Larcker criterion and cross-loading analysis.
   c) Reliability: assessed through Cronbach's Alpha (α) and Composite Reliability (CR), with thresholds > 0.70.
2. Structural Model Evaluation
   a) Path Coefficients (β): to test the strength and direction of hypothesized relationships.
   b) Coefficient of Determination (R^2): to assess the explanatory power of the model.
   c) Intervening Bootstrapping is used to estimate the level of significance among variables, including mediating effects. This process generates t-statistics and p-values to determine whether the relationships between variables are statistically significant ($p < 0.05$).

The structural paths evaluated were consistent with the five hypotheses developed in the conceptual framework (Section 2.6), examining both direct and mediated effects of green capacity building on sustainability outcomes.

3.6 Ethical Considerations

All respondents participated voluntarily and were informed of the study's purpose, ensuring compliance with ethical research principles. Data confidentiality was maintained throughout the research process. The study received institutional approval from the local implementing partner and adhered to the ethical guidelines for sustainable development research in Indonesia.

4 Result

4.1 Overview of Respondents

The survey involved 32 smallholder farmers participating in the FSC Sharing Program facilitated by PT Kirana Permata in collaboration with Pirelli. Participants were selected from multiple farmer groups within the Lubai Ulu subdistrict, Muara Enim Regency, South Sumatra, Indonesia. Of these respondents:

1. 78% were male, aged 30-55 years.
2. 87% had more than five years of experience in rubber farming.
3. 62% had previously joined at least one sustainability-related training session and
4. 75% were members of rubber-farmer cooperatives supported by Kirana Mega-tara.

This demographic composition illustrates a population with significant field experience but varying exposure to sustainability capacity-building interventions, making it suitable for analyzing behavioral and capability shifts following program participation.

4.2 Measure Model Evaluation

Convergent Validity. Convergent validity was assessed by examining the outer loading values of each indicator.

As shown in Table 2, all indicators of the Green Capacity Building construct have loading values above 0.50, indicating that the indicators are valid and meet the convergent validity criteria.

Table 2: Convergent Validity Test Results for *Green Capacity Building*

Item	Results Outer	Model Requirements Convergent	Validity Conclusion
Green Capacity Building 1	0.897	>0.5	Valid
Green Capacity Building 2	0.932	>0.5	Valid
Green Capacity Building 3	0.837	>0.5	Valid
Green Capacity Building 4	0.851	>0.5	Valid
Green Capacity Building 5	0.767	>0.5	Valid

As shown in Table 3, all indicators of the Sustainability Performance construct have loading values above 0.50, indicating that the indicators are valid and meet the convergent validity criteria.

Table 3: Convergent Validity Test Results for *Sustainability Performance*

Item	Results Outer	Model Requirements Convergent	Validity Conclusion
Sustainability Performance 1	0.764	>0.5	Valid
Sustainability Performance 2	0.791	>0.5	Valid
Sustainability Performance 3	0.909	>0.5	Valid
Sustainability Performance 4	0.741	>0.5	Valid
Sustainability Performance 5	0.737	>0.5	Valid

As shown in Table 4, all indicators of the Sustainability Performance construct have loading values above 0.50, indicating that the indicators are valid and meet the convergent validity criteria.

Table 4 Convergent Validity Test Results for *Smallholder Welfare*

Item	Results Outer	Model Requirements Convergent	Validity Conclusion
Smallholder Welfare 1	0.845	>0.5	Valid
Smallholder Welfare 2	0.893	>0.5	Valid
Smallholder Welfare 3	0.852	>0.5	Valid
Smallholder Welfare 4	0.768	>0.5	Valid
Smallholder Welfare 5	0.747	>0.5	Valid

As shown in Table 5, all indicators of the Sustainability Awareness construct have loading values above 0.50, indicating that the indicators are valid and meet the convergent validity criteria.

Table 5 Convergent Validity Test Results for *Sustainability Awareness*

Item	Results Outer	Model Requirements Convergent	Validity Conclusion
Sustainability Awareness (Z) 1	0.944	>0.5	Valid
Sustainability Awareness (Z) 2	0.951	>0.5	Valid
Sustainability Awareness (Z) 3	0.940	>0.5	Valid
Sustainability Awareness (Z) 4	0.939	>0.5	Valid
Sustainability Awareness (Z) 5	0.888	>0.5	Valid

As shown in Table 6, all indicators of the Institutional Engagement construct have loading values above 0.50, indicating that the indicators are valid and meet the convergent validity criteria.

Table 6: Convergent Validity Test Results for *Institutional Engagement*

Item	Results Outer	Model Requirements Convergent	Validity Conclusion
Institutional Engagement (Y) 1	0.854	>0.5	Valid
Institutional Engagement (Y) 2	0.906	>0.5	Valid
Institutional Engagement (Y) 3	0.837	>0.5	Valid
Institutional Engagement (Y) 4	0.847	>0.5	Valid
Institutional Engagement (Y) 5	0.907	>0.5	Valid

Based on Table 7, confirm that the items within each construct were strongly correlated and effectively measured their respective theoretical dimensions.

Table 7 Validity Test Results

Variabel	AVE
Green Capacity Building (X1)	0.737
Sustainability Performance (X2)	0.625
Smallholder Welfare (X3)	0.683
Sustainability Awareness (X4)	0.870
Institutional Engagement (Y)	0.758

Discriminant Validity. The Fornell–Larcker criterion confirmed discriminant validity, where the square roots of AVE values for each construct exceeded their correlation with other constructs. This implies that the constructs are empirically distinct and capture unique dimensions of sustainability-oriented behavior.

Table 8 Discriminant Validity Test Results

Variabel	HTMT
Green Capacity Building (X1)	0.859
Sustainability Performance (X2)	0.818
Smallholder Welfare (X3)	0.658
Sustainability Awareness (Z)	0.699

Based on the Table 8 above, all constructs have HTMT values below 0.90, which indicates that each variable meets the criteria for adequate discriminant validity. This suggests that the constructs are empirically distinct and that the indicators used in the model effectively represent their respective latent variables.

Specifically, Green Capacity Building (X1) shows the highest HTMT value of 0.859, which remains within the acceptable threshold. In contrast, Smallholder Welfare (X3) shows the lowest value of 0.658, indicating a strong level of discriminant separation.

Overall, these results confirm that the measurement model demonstrates satisfactory discriminant validity, ensuring that each construct is conceptually and statistically distinct. This provides a solid foundation for proceeding with the evaluation of the structural model in subsequent analysis.

Reliability. The variables are assessed through Cronbach's Alpha (α) and Composite Reliability (CR), with thresholds > 0.70.

Table 9: Reliability Test Results

Variable	Results	Composite Reliability Requirement	Conclusion
Green Capacity Building (X1)	0.933	>0.7	Reliable
Sustainability Performance (X2)	0.892	>0.7	Reliable
Smallholder Welfare (X3)	0.915	>0.7	Reliable
Sustainability Awareness (Z)	0.971	>0.7	Reliable
Institutional Engagement (Y)	0.940	>0.7	Reliable

Based on the Table 9 above, all constructs have Composite Reliability values greater than 0.70, indicating that each variable meets the criteria for internal consistency reliability. This means that the indicators used to measure each construct are consistent and stable in reflecting the latent variable.

Among the variables, Sustainability Awareness (Z) has the highest reliability of 0.971, indicating excellent internal consistency. Meanwhile, Sustainability Performance (X2) has the lowest reliability of 0.892, which still exceeds the minimum threshold and remains acceptable.

Overall, these results demonstrate that the measurement model has high reliability, ensuring that the constructs are measured accurately and consistently across the dataset.

Path Coefficient. Hypothesis testing in this study was conducted using the Partial Least Squares (PLS) approach to examine the relationships among the research variables. The evaluation of the path coefficients aims to determine the magnitude and direction of influence between constructs, as well as their statistical significance. The criteria for hypothesis acceptance are based on the t-statistic value greater than 1.96 and the p-value less than 0.05

Table 10 Path Coefficients Test Results

Hypothesis	Variable	Original Sample	Sample Mean	Standard Deviation	T - Statistics	P-values
H1	GCB≥ SA	0.596	0.592	0.067	8.902	0.000
H2	SP ≥ SA	0.115	0.126	0.083	1.390	0.165
H3	SW ≥ SA	0.169	0.163	0.115	1.471	0.142
H4	GCB ≥ IE	0.061	0.065	0.049	1.231	0.219
H5	SP ≥ IE	0.087	0.087	0.042	2.079	0.038
H6	SW ≥ IE	0.234	0.237	0.052	4.533	0.000
H7	SA ≥ IE	0.674	0.665	0.058	11.709	0.000

Based on the Table 10 above, the results indicate that four hypotheses (H1, H5, H6, and H7) are accepted, as their t-statistic values exceed 1.96 and p-values are below 0.05. Meanwhile, three hypotheses (H2, H3, and H4) are rejected, as their p-values exceed 0.05, indicating that the relationships among the variables are not statistically significant.

1. H1 (GCB → SA): The path coefficient of 0.596 with t = 8.902 and p = 0.000 indicates that Green Capacity Building has a strong and significant positive effect on Sustainability Awareness.
2. H2 (SP → SA) and H3 (SW → SA) show p-values of 0.165 and 0.142, respectively, which are above 0.05, indicating that Sustainability Performance and Smallholder Welfare do not significantly affect Sustainability Awareness.
3. H4 (GCB → IE) also shows a non-significant relationship (p = 0.219), indicating that Green Capacity Building does not directly influence Institutional Engagement.
4. H5 (SP → IE) is significant (p = 0.038), indicating that Sustainability Performance has a positive and significant effect on Institutional Engagement.
5. H6 (SW → IE) is significant (p = 0.000), indicating that Smallholder Welfare positively and significantly affects Institutional Engagement.
6. H7 (SA → IE) has the highest coefficient (0.674) and is highly significant (p = 0.000), suggesting that Sustainability Awareness plays a dominant role in enhancing Institutional Engagement.

Overall, the results highlight that Sustainability Awareness is a key variable influencing Institutional Engagement. At the same time, Green Capacity Building significantly improves Sustainability Awareness, which may act as an intervening factor in the model.

Coefficient of Determination (R^2). The Coefficient of Determination (R^2) test is used to measure the model's explanatory power, specifically the extent to which the exogenous (independent) variables in the research model explain the variance of the endogenous (dependent) variables. According to [8], the R^2 values can be categorized as follows: 0.75 (substantial), 0.50 (moderate), and 0.25 (weak). A higher R^2 value indicates a stronger predictive accuracy of the model**.**

Table 11 Coefficient of Determination (R^2) Test Results

Variable	R-*Square*
Sustainability Awareness (Z)	0.651
Institutional Engagement (Y)	0.911

Based on the Table 11 above, the R^2 value for Sustainability Awareness (Z) is 0.651, indicating that approximately 65.1% of the variance in Sustainability Awareness can be explained by the independent variables (Green Capacity Building, Sustainability Performance, and Smallholder Welfare). This value falls within the moderate category, indicating that the model has a reasonably good ability to predict Sustainability Awareness.

Meanwhile, the R^2 value for Institutional Engagement (Y) is 0.911, indicating that 91.1% of the variance in Institutional Engagement is explained by the independent variables (Green Capacity Building, Sustainability Performance, Smallholder Welfare) and the intervening variable (Sustainability Awareness). This indicates very strong (substantial) explanatory power, suggesting that the combination of these variables provides a robust prediction of Institutional Engagement.

Intervening Bootstrapping. The mediation test aims to determine whether the mediating variable, Sustainability Awareness (SA), significantly mediates the relationships among the exogenous variables (Green Capacity Building, Sustainability Performance, and Smallholder Welfare) and the endogenous variable (Institutional Engagement).

This analysis was conducted using the Bootstrapping method with a significance level of $p < 0.05$. The mediation effect is considered significant when the t-statistic value is greater than 1.96, and the p-value is less than 0.05.

Table 12 Intervening Bootstrapping Test Results

Variabel	Original Sample	T Statistic	P Values	Description
GCB → SA → IE	0,401	6,793	0,000	Mediated
SP → SA → IE	0,078	1,421	0,156	Not Mediated
SW → SA → IE	0,114	1,503	0,133	Not Mediated

Based on the Table 12 above, it can be observed that only one indirect relationship demonstrates a significant mediating effect:

1. GCB → SA → IE has an Original Sample value of 0.401, a t-statistic of 6.793, and a p-value of 0.000 (< 0.05). This indicates that Sustainability Awareness (SA) significantly mediates the relationship between Green Capacity Building (GCB) and Institutional Engagement (IE). In other words, improvements in Green Capacity Building enhance Sustainability Awareness, thereby increasing Institutional Engagement.
2. Meanwhile, SP → SA → IE (p = 0.156) and SW → SA → IE (p = 0.133) both have p-values> 0.05 and t-statistics < 1.96. This means that Sustainability Awareness does not significantly mediate the relationships between Sustainability Performance, Smallholder Welfare, and Institutional Engagement.

Overall, these results imply that Sustainability Awareness serves as a partial mediator, specifically between Green Capacity Building and Institutional Engagement. At the same time, no mediating effect is observed for the other two paths. This finding underscores the importance of strengthening Sustainability Awareness as a strategic channel through which Green Capacity Building can effectively enhance Institutional Engagement.

4.3 Discussion

Based on the results of hypothesis testing using the Partial Least Squares (PLS) method, an overview of the relationships between variables in this research model was obtained, showing how Green Capacity Building (GCB), Sustainability Performance (SP), and Smallholder Welfare (SW) affect Sustainability Awareness (SA) and Institutional Engagement (IE), both directly and indirectly through mediation mechanisms. In general, the analysis results show that most of the tested relationships are positive, although not all are statistically significant.

The results of the test on H1 show that Green Capacity Building has a positive and significant effect on Sustainability Awareness, with a value of T = 8.902 and P = 0.000. This indicates that increasing green capacity through training, coaching, and strengthening human resource competencies can raise awareness of the importance of sustainability. Conversely, the results for H2 and H3 show that Sustainability Performance and Smallholder Welfare do not have a significant effect on Sustainability Awareness (P = 0.165 and 0.142, respectively). This means that improving sustainable performance and smallholder welfare does not, in itself, increase sustainability awareness without adequate knowledge and capacity support.

Furthermore, testing the direct relationship with Institutional Engagement showed mixed results. In H4, the effect of Green Capacity Building on Institutional Engagement was found to be insignificant (P = 0.219), suggesting that green capacity building does not necessarily increase institutional engagement without prior awareness. However, different results were found in H5 and H6, where Sustainability Performance (P = 0.038) and Smallholder Welfare (P = 0.000) had positive, significant effects on Institutional Engagement. This means that improvements in sustainability performance and smallholder welfare can strengthen institutions' roles in collaborative and participatory activities. Meanwhile, H7 shows a very strong influence between Sustainability Awareness and Institutional Engagement (T = 11.709; P = 0.000), which confirms that the higher the level of sustainability awareness, the greater the institutional involvement in supporting sustainable programs and policies.

The results of the coefficient of determination (R^2) test also reinforce these findings. The R^2 value for Sustainability Awareness is 0.651, indicating that 65.1% of the variation in sustainability awareness can be explained by the variables GCB, SP, and SW. Meanwhile, the R^2 value for Institutional Engagement is 0.911, indicating that 91.1% of the variation in institutional engagement is explained by all exogenous variables in the model. This value is relatively high, indicating that the research model has strong explanatory power and that it is feasible to proceed to a more in-depth structural analysis.

Furthermore, the mediation test results (interventional bootstrapping) indicate that only one path is significant: the effect of Green Capacity Building on Institutional Engagement through Sustainability Awareness ($\beta = 0.401$; $T = 6.793$; $P = 0.000$). This result confirms that sustainability awareness plays an important mediating role in strengthening the influence of green capacity building on institutional engagement. Meanwhile, the indirect effects of Sustainability Performance and Smallholder Welfare on Institutional Engagement through Sustainability Awareness were not significant, with P values of 0.156 and 0.133, respectively. Thus, these two variables have a greater direct effect on institutional engagement than through the mediating mechanism of sustainability awareness.

Overall, of the ten hypotheses tested, five were found to be significant, namely H1, H5, H6, H7, and H8. These findings show that Sustainability Awareness plays a key role in bridging the influence of Green Capacity Building on Institutional Engagement, and that Sustainability Performance and Smallholder Welfare directly strengthen institutional participation. Thus, this research model shows a strong structural relationship and underscores the importance of strengthening green awareness and capacity to enhance institutional collaboration and commitment to sustainable development.

5 Conclusion

Based on the research results, it can be concluded that Green Capacity Building has a significant effect on Institutional Engagement through Sustainability Awareness as a mediating variable. This means that increasing green capacity and competence can foster sustainability awareness, ultimately boosting institutional engagement in sustainable activities.

Meanwhile, Sustainability Performance and Smallholder Welfare have a direct effect on Institutional Engagement, but not through Sustainability Awareness. This shows that improving sustainable performance and smallholder welfare can strengthen institutions' roles directly, without being mediated by sustainability awareness.

The high R^2 value (0.911 for Institutional Engagement) indicates that this research model has strong explanatory power. Overall, these results emphasize the importance of increasing green capacity and sustainability awareness in strengthening institutional collaboration and commitment to sustainable development goals.

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