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Research Article

Applying Satoyama-Based Perception Indicators to Assess Community Support for Sustainable Can Gio Mangrove Livelihood Management

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Abstract

Mangrove management increasingly requires evidence that connects ecological protection with the livelihood expectations and governance experience of resident communities. This study reframes the Can Gio mangrove case through a Satoyama-based social-ecological perception framework and assesses the factors shaping community acceptance and support for sustainable livelihood management. The analysis uses the available household-survey dataset, field-route information and field photographs from Can Gio, with latent constructs representing social-ecological awareness (SEA), ecosystem-based livelihood value (VLS), local social capital (LSC), governance and policy trust (GOV), and acceptance/support for Satoyama-based management (ACP). Internal consistency was evaluated using Cronbach's Alpha, and the influence of the four explanatory constructs on ACP was interpreted through standardized path coefficients. Results show reliable measurement scales, with Alpha values ranging from 0.79 for GOV to 0.90 for ACP. All structural paths are positive and statistically significant: SEA has the strongest association with support (beta = 0.34, $p < 0.001$), followed by VLS (beta = 0.29, $p < 0.001$), LSC (beta = 0.21, $p < 0.01$) and GOV (beta = 0.18, $p < 0.01$). The findings indicate that household support for sustainable mangrove livelihoods depends not only on economic benefits, but also on perceived social-ecological integrity, community cooperation and transparent local governance. The study provides a compact empirical basis for community-centered planning in a biosphere reserve context. A Satoyama-based approach is therefore suitable for organizing Can Gio mangrove management around ecological restoration, livelihood diversification and community participation.

Keywords: *Satoyama Initiative; social-ecological systems; mangrove livelihoods; community perception; PLS-SEM: Can Gio.*

I. INTRODUCTION

Mangrove landscapes are among the most productive and socially important coastal ecosystems. They support nursery habitats for aquatic species, regulate sediment and nutrient flows, reduce coastal hazard exposure, store carbon and provide direct livelihood opportunities through fisheries, aquaculture, fuelwood, tourism and cultural uses [1], [2], [3], [4], [5], [6]. These functions are rarely separable in practice. In a populated deltaic coast, ecological integrity is sustained or degraded through daily decisions made by households, local authorities, market actors and conservation institutions. For this reason, a purely biophysical assessment of mangroves is insufficient for explaining whether a management model will be accepted and maintained over time.

Can Gio, located in the coastal zone of Ho Chi Minh City, is internationally recognized as a mangrove biosphere reserve under the UNESCO Man and the Biosphere Programme [7]. Its mangrove system has ecological, protective and economic value, while local livelihoods remain linked to fishing, aquaculture, salt production, tourism, small trade and resource-related services. The area therefore represents a typical social-ecological production landscape and seascape, where conservation outcomes and livelihood outcomes are co-produced. Management decisions that strengthen the forest but weaken household income may face low compliance, whereas livelihood interventions that ignore ecosystem thresholds may reduce long-term resilience.

The global literature on mangrove management has repeatedly shown that restoration, protection zoning and ecosystem-service valuation are more durable when local users understand the ecological logic of conservation and receive credible benefits from sustainable use [8], [9], [10]. Mangroves can reduce exposure to storms and extreme events, but their protection value depends on spatial continuity, species composition and community stewardship [11], [1]. At the same time, households often evaluate conservation rules through livelihood security, fairness, consultation and trust. These social dimensions influence whether communities view protected landscapes as shared assets or external restrictions.

The Satoyama Initiative offers a useful framework for this type of problem because it emphasizes the dynamic relationship between human well-being, biodiversity and landscape management [12], [13]. Although the Satoyama concept originated from Japanese rural landscapes, its broader interpretation is relevant to many social-ecological production landscapes and seascapes. It does not treat people and nature as separate domains. Instead, it asks whether production activities can be redesigned so that ecosystem functions, local knowledge, cultural identity and economic value reinforce one another [14], [15].

A Satoyama-based perspective is particularly relevant for mangrove livelihoods because coastal households depend on multiple resource flows rather than on a single commodity. Shrimp-mangrove models, small-scale fishing, ecotourism and local trade all require some level of ecological stability, institutional coordination and community cooperation. The core question is therefore not simply whether mangrove cover can be mapped or whether biodiversity is present. A more policy-relevant question is whether local residents perceive sustainable mangrove-based livelihood management as legitimate, beneficial and feasible.

Social-ecological systems research provides the theoretical basis for this shift. Resilience scholarship argues that ecological systems and social institutions interact through feedbacks, learning and adaptive capacity [16], [17], [18]. Ostrom [19] further demonstrates that sustainable resource governance depends on resource systems, user characteristics, governance arrangements and outcomes considered together. In such settings, local perceptions are not merely subjective opinions; they are signals of the social conditions under which policies are accepted, negotiated or resisted.

Community perception is also closely related to social capital. Trust, shared norms and cooperation can reduce transaction costs in collective management and improve the ability of households to respond to ecological or market shocks [20], [21], [22]. Where social capital is high, local users are more likely to share information, monitor rule compliance and support adaptive management. Where governance is perceived as distant or opaque, even technically sound conservation interventions may face weak participation.

Methodologically, these relationships can be examined using latent constructs and path modeling. Partial least squares structural equation modeling (PLS-SEM) is suitable for exploratory and prediction-oriented research that connects perception scales with a target outcome, especially when constructs are measured by multiple survey items [23], [24], [25], [26], [27], [28], [29], [30]. Reliability analysis through Cronbach's Alpha helps determine whether the items within each construct represent a coherent perception dimension [31], [32].

This approach also responds to a practical problem in biosphere-reserve management. Managers often need indicators that are simple enough to communicate with local communities, but robust enough to support policy evaluation. Spatial maps and ecological indicators are valuable, and participatory mapping can identify land-use conflict potential when spatial evidence is available [33], yet they do not directly measure whether households understand the conservation-livelihood linkage, trust the implementation process or believe that sustainable practices can improve income security. A perception framework can therefore complement ecological monitoring by identifying the social conditions that make conservation feasible. In Can Gio, this is important because livelihood groups do not experience mangrove rules in the same way. Tourism households, fishers, aquaculture households, traders and agricultural households may all benefit from mangrove functions, but their incentives, risks and expectations differ.

Although Can Gio can also be investigated through remote sensing, GIS layers and ecological field sampling, the dataset used in this study is strongest for a social-science argument: it contains household survey profiles, Satoyama-related perception items, reliability coefficients and structural path results. Therefore, this manuscript frames the study as a social-ecological perception assessment rather than a spatial ecological mapping exercise. The objective is to evaluate how social-ecological awareness, ecosystem-based livelihood value, local social capital and governance trust shape acceptance and support for sustainable mangrove livelihood management in Can Gio. Four positive hypotheses are examined: SEA, VLS, LSC and GOV each positively influence ACP.

II. MATERIALS AND METHODS

A. Study area and source data

The study focuses on Can Gio, a mangrove-dominated coastal district of Ho Chi Minh City, Viet Nam. The field materials include a survey-route map, photographs of household interviews and livelihood settings, and profile charts describing the distribution of respondents by location, livelihood and age group. The survey locations cover settlement, port, ecological tourism and waterway contexts, including Can Thanh, Long Hoa, Hoa Hiep, Vam Sat and Dan Xay areas. These locations represent the practical interface between mangrove conservation, aquaculture, fishing, tourism and local governance.

B. Research design

The revised design is a perception-based social-ecological assessment. Rather than estimating mangrove vegetation indices or biodiversity plots, the analysis treats households as knowledgeable observers of the production landscape. The central dependent construct is acceptance/support for Satoyama-based management (ACP). Four explanatory constructs are used: social-ecological awareness (SEA), ecosystem-based livelihood value (VLS), local social capital (LSC), and governance and policy trust (GOV). The questionnaire items were organized as Likert-type indicators, where higher scores represent stronger agreement with each statement.

C. Construct coding

The source questionnaire used five latent constructs. To ensure consistency with the reliability and path-coefficient tables, the economic construct originally labelled SEAN is standardized as VLS, and the social-capital construct originally labelled SOC is standardized as LSC. This does not change the meaning of the original items; it only harmonizes the notation across tables and figures. The full list of constructs and measurement items is reported in Table I.

The score for each latent construct was calculated as the arithmetic mean of its constituent Liker-type items:

$$C_m = \frac{1}{p_m}\sum_{j=1}^{p_m} x_{mj} \tag{1}$$

Where: C_m: The final score of latent construct m for an individual respondent. p_m: The total number of observed measurement items within construct m. x_{mj}: The individual response score for item j belonging to construct m.

This average-score formulation was used to explain the construction of latent perception dimensions before reliability and path interpretation.

The reliability of the measurement scales was assessed using Cronbach's Alpha:

$$\alpha = \left(\frac{k}{k-1}\right)\left[1-\frac{\sum_{i=1}^{k}\sigma_i^2}{\sigma_T^2}\right] \tag{2}$$

Where: α: Cronbach's Alpha reliability coefficient. k: The number of items in the specific scale. σ_i^2: The variance of the individual item i. σ_T^2: The total variance of the sum of all items in the scale. Alpha values above 0.70 are generally interpreted as acceptable for exploratory social-science research, while values above 0.80 indicate good internal consistency [31], [32].

To compare profile variables on a standardized scale, the min-max normalization was used:

$$z_{ij} = \frac{x_{ij}-\min(x_j)}{\max(x_j)-\min(x_j)} \tag{3}$$

Where: z_{ij}: The normalized value of observation i for variable j. x_{ij}: The original raw value of the observation. $\min(x_j)$ and $\max(x_j)$: The minimum and maximum values observed for variable j in the dataset, respectively. This min-max form is reported to clarify how descriptive profile variables can be displayed on comparable percentage or normalized scales.

The theoretical relationship between social-ecological constructs and community support was modeled as follows:

$$ACP = \beta_1 SEA + \beta_2 VLS + \beta_3 LSC + \beta_4 GOV + \epsilon \tag{4}$$

Where: ACP Acceptance/support for Satoyama-based management (Dependent variable). $\beta_1, \dots, \beta_4$: Standardized path coefficients (effect sizes). SEA, VLS, LSC, GOV: Latent constructs for awareness, livelihood value, social capital, and governance trust, respectively.

The statistical significance of each path was determined by the t-statistic:

$$t = \frac{\beta}{SE(\beta)} \tag{5}$$

Where: t: The calculated test statistic for the path coefficient. β: The standardized path coefficient estimated by PLS-SEM. $SE(\beta)$: The standard error of the coefficient, typically derived via bootstrapping.

D. Analytical procedure

The analysis proceeded in four steps. First, the field-route and survey-profile materials were reorganized into descriptive figures. Second, the questionnaire items were translated into standardized construct notation. Third, reliability was assessed using Cronbach's Alpha for each construct. Fourth, the structural paths from SEA, VLS, LSC and GOV to ACP were interpreted as standardized effects. This procedure fits the available dataset and clearly distinguishes the present perception analysis from spatial ecological assessment that would require additional biophysical data.

E. Reporting and quality control

The manuscript reports only results that are directly supported by the source materials: field context, survey profiles, measurement items, reliability coefficients and structural path coefficients. Descriptive percentages are used for household profiles because the extracted source charts report proportions rather than a separate raw-count table. The reliability and path results are interpreted as evidence of scale coherence and directional association, not as proof of ecological condition. This reporting rule is important for scientific transparency because it separates perception-based findings from biophysical monitoring outputs that would require additional remote-sensing layers, vegetation plots, species inventories or time-series validation.

III. RESULTS

Fig. 1 summarizes the spatial and field context of the survey. The route map and field photographs confirm that the dataset was collected across livelihood settings where mangrove conservation, fishing, aquaculture, tourism and local settlement activities overlap. This field basis is important because the Satoyama framework requires observation of human-nature interactions rather than only administrative boundaries or remote-sensing units.

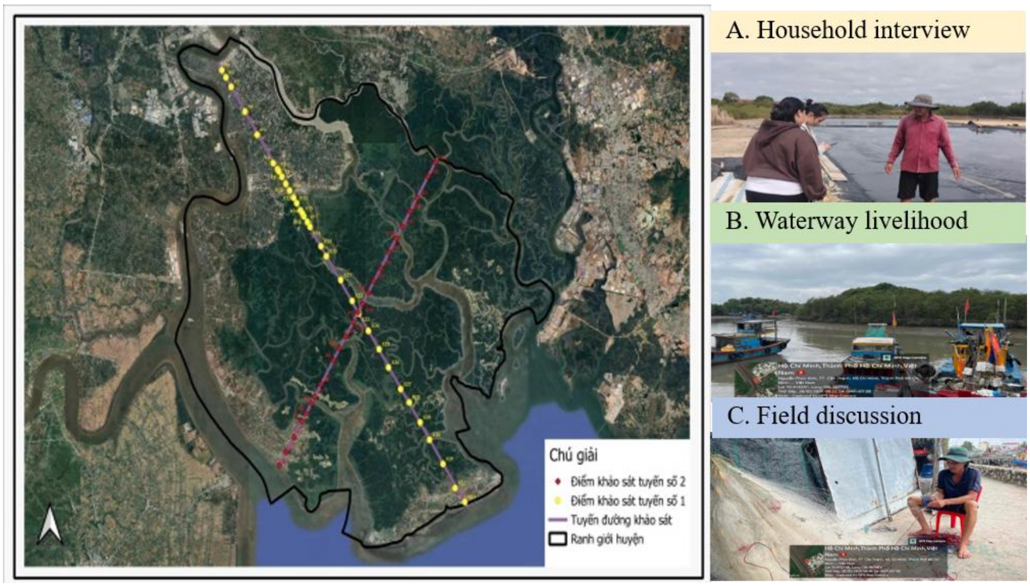

Fig. 1. Study area, survey routes and field survey photographs

Specifically, the field photographs illustrate core Satoyama dimensions: panel A depicts the elicitation of indigenous knowledge through participatory household interviews; panel B captures the integrated production seascape where local livelihoods are directly embedded within the mangrove fringes; and panel C highlights the dynamic of local social capital and community-based consultation, which are essential for sustainable landscape governance.

The household profile in Fig. 2 indicates a heterogeneous survey structure. The largest field-location shares are associated with Can Thanh port, Hoa Hiep, Long Hoa and Dan Xay, while smaller shares represent settlement and ecological-tourism sites. Livelihood composition is dominated by tourism (36.6%), trade (17.8%) and fishing (16.8%), followed by agriculture (10.9%) and smaller aquaculture-related categories. The age profile is also broad, with respondents concentrated in the 18-30 (36.6%), 31-45 (30.7%) and 46-60 (21.8%) groups. This profile supports a perception-based analysis because the respondents represent different livelihood exposures and stages of household decision-making.

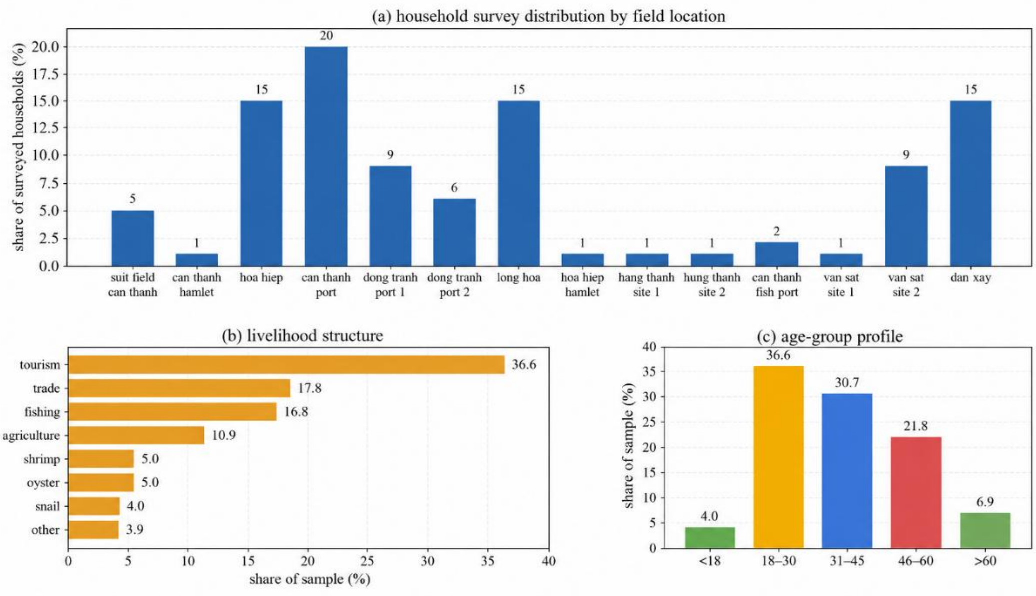

Fig. 2. Household survey profile by location, livelihood, and age group

Table I presents the measurement structure. SEA captures whether respondents understand mangrove livelihoods as part of an integrated social-ecological system. VLS captures perceived economic benefits from ecosystem-compatible livelihoods, including shrimp-mangrove integration, local product value and livelihood diversification. LSC measures community leadership, local knowledge, cooperation and adaptive capacity. GOV measures the perceived effectiveness, fit and transparency of local governance. ACP is the outcome construct and reflects support for scaling ecological shrimp-mangrove models, maintaining responsible production practices, accepting a Satoyama governance framework and prioritizing sustainability in the long term.

TABLE I: Latent constructs and measurement items

Construct	Meaning	Code	Measurement item
SEA	Social-ecological awareness	SEA1	Maintaining harmony between the mangrove ecosystem and locally specific livelihood practices.
SEA	Social-ecological awareness	SEA2	Sustainable resource use is closely linked to conserving ecological functions.
SEA	Social-ecological awareness	SEA3	Conserving the multifunctionality of the coastal landscape, including ecological, economic and cultural values.
SEA	Social-ecological awareness	SEA4	A balance between resource use and restoration is a prerequisite for long-term development.
VLS	Ecosystem-based livelihood value	VLS1	Integrated models such as shrimp-mangrove systems support income stability and household security.
VLS	Ecosystem-based livelihood value	VLS2	Ecosystem conservation increases the brand value of local agricultural and aquatic products.
VLS	Ecosystem-based livelihood value	VLS3	Livelihood diversification strengthens household resilience to economic shocks.
VLS	Ecosystem-based livelihood value	VLS4	Household economic efficiency should be compatible with natural conditions and ecosystem functions.
LSC	Local social capital	LSC1	Local communities should play a leading role in coastal resource governance.
LSC	Local social capital	LSC2	Indigenous knowledge and local experience are core resources for resource management.
LSC	Local social capital	LSC3	Cooperation among households helps maintain ecological balance in the area.
LSC	Local social capital	LSC4	Active community participation increases adaptive capacity to climate change.
GOV	Governance and policy trust	GOV1	Local authorities effectively coordinate and manage coastal resources.
GOV	Governance and policy trust	GOV2	Current sustainable-development policies are compatible with local realities.

GOV	Governance and policy trust	GOV3	Community consultation mechanisms are transparent in resource-related decisions.
ACP	Support for Satoyama-based management	ACP1	Support for implementing and scaling ecological shrimp-mangrove models in the locality.
ACP	Support for Satoyama-based management	ACP2	Commitment to maintaining environmentally responsible production practices.
ACP	Support for Satoyama-based management	ACP3	Recognition that a Satoyama-based governance framework fits the Can Gio context.
ACP	Support for Satoyama-based management	ACP4	Sustainable development is a priority in the area's long-term strategic vision.

Fig. 3 visualizes the conceptual and empirical path model. The model assumes that household support for Satoyama-based mangrove livelihood management is influenced by ecological understanding, livelihood benefits, community cooperation and governance trust. This structure is consistent with the social-ecological systems literature, where acceptance is shaped by both material benefits and institutional relationships.

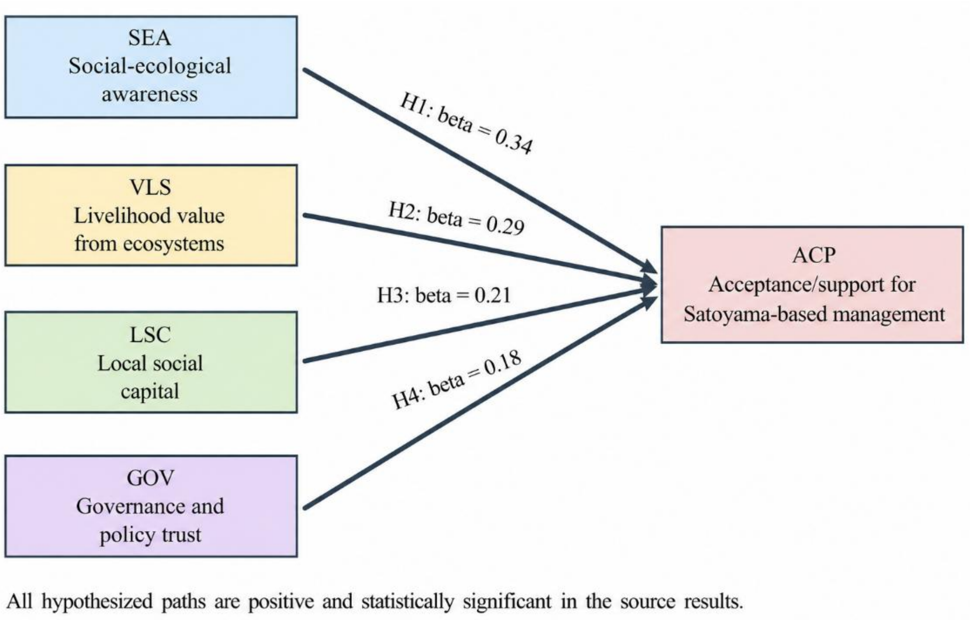

Fig. 3. Conceptual/PLS-SEM model of Satoyama constructs

Reliability results in Table II and Fig. 4 show that all constructs satisfy commonly accepted internal-consistency thresholds. ACP has the highest Cronbach's Alpha (0.90), indicating a very coherent support scale. SEA also performs strongly (0.87), suggesting that respondents evaluate social-ecological harmony, ecological functions, multifunctionality and restoration balance as a consistent perception domain. VLS (0.84) and LSC (0.82) are also reliable, while GOV (0.79) remains above the 0.70 threshold and is acceptable for exploratory community-perception research.

TABLE II: Reliability test of Satoyama-based constructs

Construct	Cronbach's Alpha	Interpretation
SEA	0.87	Very high; reflects strong understanding of social-ecological integrity.
VLS	0.84	Good; indicates consistent expectations about ecosystem-based economic benefits.
LSC	0.82	Good; confirms the strength of community linkage and cooperation.
GOV	0.79	Acceptable; reflects trust in local governance institutions.
ACP	0.90	Very good; confirms internal consistency of acceptance/support items.

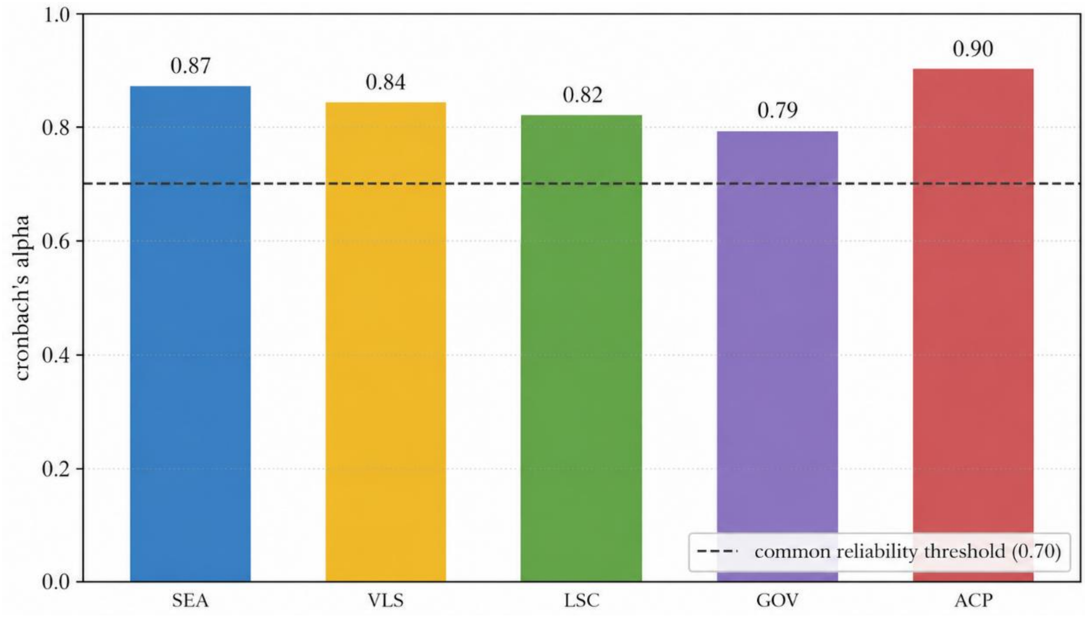

Fig. 4. Cronbach's Alpha by construct

The structural coefficients in Table III show that all four explanatory constructs positively influence ACP. SEA has the strongest standardized coefficient (beta = 0.34, t = 5.21, $p < 0.001$), indicating that respondents who better recognize the link between mangrove ecological functions and livelihood sustainability are more likely to support the proposed management model. VLS is the second strongest driver (beta = 0.29, t = 4.87, $p < 0.001$), confirming that support increases when households perceive ecosystem-compatible livelihoods as economically valuable.

TABLE III: Structural path coefficients influencing sustainable acceptance/support

Path	Dimension	Beta	t-value	p-value	Empirical meaning
SEA -> ACP	Ecological/social-ecological awareness	0.34	5.21	<0.001	Most important driver
VLS -> ACP	Ecosystem-based livelihood value	0.29	4.87	<0.001	Foundational livelihood driver
LSC -> ACP	Local social capital	0.21	3.65	<0.01	Supporting social driver
GOV -> ACP	Governance and policy trust	0.18	2.94	<0.01	Institutional enabling driver

The remaining paths are smaller but still statistically significant. LSC has a positive effect on ACP (beta = 0.21, t = 3.65, $p < 0.01$), showing that cooperation, local knowledge and community participation matter for sustainable livelihood acceptance. GOV also has a positive effect (beta = 0.18, t = 2.94, $p < 0.01$), suggesting that policy fit, transparent consultation and effective local management help build support, although their direct effect is weaker than ecological awareness and livelihood value. Fig. 5 ranks the relative effects and shows a clear order: SEA > VLS > LSC > GOV.

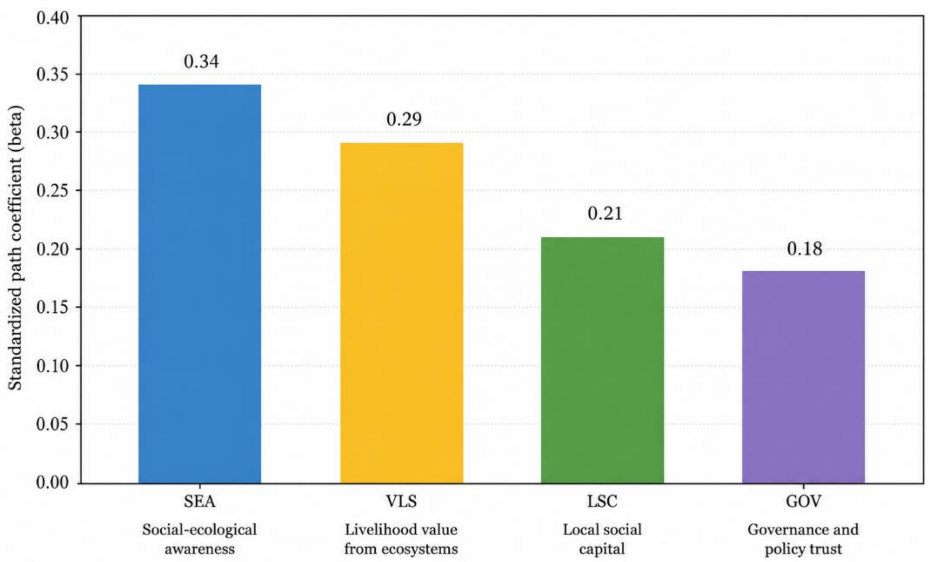

Fig. 5. Relative effects of SEA, VLS, LSC, and GOV on ACP

A further implication of the results is that ACP should be read as a multi-dimensional support outcome rather than a single attitude toward conservation. The ACP items combine support for ecological shrimp-mangrove models, commitment to responsible production, perceived fit of the Satoyama framework and a long-term sustainability orientation. The high reliability of ACP therefore indicates that these four elements move together in the survey evidence. Households that support one element of sustainable management tend to support the broader package, which is encouraging for integrated policy design.

Overall, the results support a Satoyama-based household perception model. The available evidence is not primarily a GIS-driven ecosystem-health index, because it does not include complete remote-sensing layers, ecological plot statistics or spatial model outputs. In contrast, the survey data are well aligned with a household perception model. The strongest evidence lies in the internally consistent scales and the statistically significant path coefficients explaining community acceptance/support.

IV. DISCUSSION

The findings reinforce a central claim of social-ecological systems research: sustainable management is not achieved by ecological restoration alone, but by aligning ecological functions with local livelihoods, institutions and learning processes [16], [17], [19]. In Can Gio, SEA is the strongest predictor of acceptance/support. This means that households are more likely to endorse sustainable mangrove livelihood management when they recognize that long-term income security depends on mangrove functions such as nursery habitat, shoreline protection and ecological balance. This result is consistent with the Satoyama Initiative, which emphasizes rebuilding the relationship between people and nature through production landscapes that maintain biodiversity and human well-being [12], [13].

The strong effect of SEA also suggests that environmental knowledge and ecological literacy should be treated as management resources. Studies on mangrove ecosystems show that communities often understand the protective and productive functions of mangroves through direct experience, especially after storms, erosion events or fishery changes [11], [8]. The Can Gio result is compatible with this literature because it shows that perceived social-ecological integrity is not an abstract attitude. It is a practical basis for supporting livelihood models that require restraint, restoration and long-term thinking.

VLS is the second strongest driver, which confirms that community support depends on credible livelihood benefits. This finding agrees with ecosystem-service and mangrove-management studies showing that conservation gains are more likely to persist when households receive income, risk reduction or market advantages from sustainable practices [2], [4], [9]. For Can Gio, ecological shrimp-mangrove systems, tourism services, local product branding and livelihood diversification can translate conservation into household value. However, livelihood benefits must be designed carefully. If they are captured by a small group or depend on unstable markets, they may weaken rather than strengthen community legitimacy.

The positive effect of LSC supports the argument that community cooperation is a core condition for managing common resources. Pretty [20] identifies social capital as a basis for collective action, while Berkes [21] stresses knowledge generation, bridging organizations and social learning in co-management. In the present results, LSC is not the largest coefficient, but it is significant. This implies that cooperation among households, respect for local knowledge and active participation increase acceptance even after ecological awareness and livelihood value are considered. For Can Gio, this may be especially important because mangrove livelihoods are spatially connected: fishing, aquaculture, tourism and waterway activities affect one another through shared ecological conditions.

GOV has the smallest direct coefficient, but its significance should not be underestimated. Governance trust may operate partly through indirect pathways, such as improving livelihood-program credibility or enabling communities to use ecological knowledge in decision-making. Ostrom's [19] framework emphasizes that rules, monitoring, sanctions and conflict-resolution mechanisms must fit local social and ecological conditions. The GOV result suggests that residents support Satoyama-based management more when policies are seen as transparent, locally relevant and consultative. This is consistent with broader evidence that top-down conservation can face resistance when community voice is weak, whereas participatory governance improves compliance and learning.

Compared with a GIS-based ecosystem-health approach, the present perception model offers a defensible contribution because it matches the actual evidence. Remote sensing and spatial ecological assessment remain valuable for Can Gio, especially for monitoring mangrove extent, fragmentation and restoration outcomes. Yet such approaches answer a different question. They show where ecosystem conditions are changing, but not necessarily why households support or reject a management model. The present analysis fills that social-ecological gap by explaining acceptance/support through measurable perception constructs. Future work could integrate both approaches by linking household perception scores with mapped mangrove condition, land-use change and livelihood zones.

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The results also fit the broader Satoyama literature on social-ecological production landscapes and seascapes. Gu and Subramanian [14] argue that drivers of change in such landscapes include economic transformation, governance, local knowledge and ecosystem dynamics. The Can Gio model operationalizes these ideas in a compact empirical form: SEA represents ecosystem understanding, VLS represents livelihood value, LSC represents collective capacity and GOV represents institutional trust. ACP then captures whether these dimensions translate into support for sustainable management. This makes the framework suitable for practical policy evaluation and for comparing communities or livelihood groups in future surveys.

For policy practice, the ranking of effects suggests a sequence of intervention. Ecological communication should come first, because SEA has the strongest relationship with support. Livelihood programs should then demonstrate tangible household value through market access, product certification, tourism linkages or risk-reducing production models. Community cooperation mechanisms, such as household groups or participatory monitoring, can strengthen LSC, while transparent consultation can improve GOV. This sequence is compatible with adaptive co-management because it begins with shared understanding, builds material incentives and then consolidates collective rules through trust and participation.

Several limitations should be acknowledged. First, the dataset is cross-sectional and perception-based, so the results should be interpreted as associations rather than causal proof. Second, the available source material reports profile percentages and path statistics but does not provide full raw respondent-level data in the extracted file. This limits the ability to conduct additional tests such as convergent validity, discriminant validity, R-squared, effect size or predictive relevance, including Fornell-Larcker criteria and broader covariance-based SEM diagnostics [34], [35]. Third, the current evidence does not support claims about Sentinel imagery, ecological sampling plots or a spatial SEHI map. These elements should be added only if independent spatial and ecological datasets are available. Despite these limitations, the reliability and path results are sufficient for a coherent manuscript focused on Satoyama-based perception and community support.

V. CONCLUSION

This revised manuscript demonstrates that the available Can Gio dataset is best suited to a Satoyama-based social-ecological perception analysis. The measurement structure is coherent, with reliable constructs for social-ecological awareness, ecosystem-based livelihood value, local social capital, governance trust and acceptance/support. All Cronbach's Alpha values exceed the common reliability threshold, and the support construct shows particularly strong internal consistency.

The structural results indicate that community acceptance/support for sustainable mangrove livelihood management is shaped most strongly by social-ecological awareness, followed by perceived livelihood value, local social capital and governance trust. This ranking has clear policy implications. Sustainable management in Can Gio should not rely only on administrative protection or technical restoration. It should combine ecological education, ecosystem-compatible livelihood incentives, community cooperation mechanisms and transparent consultation.

For implementation, the most immediate priority is to translate the Satoyama framework into practical local programs. Training and communication can strengthen ecological awareness; shrimp-mangrove and tourism models can connect conservation with household income; community groups can reinforce cooperation; and open consultation can increase institutional legitimacy. These actions should be monitored with both perception indicators and ecological indicators so that managers can evaluate whether social support and mangrove condition improve together.

The main contribution of the study is a defensible reframing of the research problem. Rather than extending beyond the available survey evidence, the manuscript explains why residents may support Satoyama-oriented mangrove livelihood management. Future research should add raw respondent-level data, larger samples, longitudinal follow-up and spatial ecological indicators so that perception pathways can be connected with observed mangrove condition. Even in its current form, the study provides a practical framework for designing community-centered mangrove policies in Can Gio and comparable coastal social-ecological landscapes.

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