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Strategic Tourism Planning for Sustainable Regional Development of Hutaraja Hot Spring

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ABSTRACT

This study examines whether Planning Strategies mediate the relationship between Hot Spring Assets and Regional Development at Aek Milas Hot Spring in Hutaraja Village, Mandailing Natal Regency, Indonesia. The destination combines geothermal water, a river ecosystem, agricultural landscapes, and Mandailing cultural resources, but limited facilities, weak market visibility, and fragmented stakeholder coordination constrain its development. We conducted an explanatory cross-sectional survey of stakeholders directly familiar with the destination. Of an accessible population of 75 stakeholders, we retained and analyzed 65 complete questionnaires using partial least squares structural equation modeling (PLS-SEM) with 5,000 bootstrap resamples. Hot Spring Assets were positively associated with Planning Strategies ($\beta = 0.584$, $t = 6.742$, $p < 0.001$), while Planning Strategies were positively associated with Regional Development ($\beta = 0.621$, $t = 7.185$, $p < 0.001$). The indirect effect of Hot Spring Assets on Regional Development through Planning Strategies was also significant ($\beta = 0.363$, $t = 5.214$, $p < 0.001$). These findings show that the developmental value of geothermal resources depends not only on resource attractiveness but also on planning capabilities that coordinate infrastructure, governance, community enterprise, digital communication, and environmental protection. The study's novelty lies in testing Planning Strategies as a mediating capability in a rural geothermal destination, thereby linking resource-based logic with sustainable destination development. The model provides a context-specific basis for integrated planning in Hutaraja and similar emerging geothermal destinations.

Keywords: Geothermal Tourism, Regional Development, Strategic Tourism Planning, Sustainable Tourism, & Tourism Governance

1. Introduction

Tourism is widely used to diversify local economies, create jobs, improve infrastructure, and support cultural and environmental stewardship. Contemporary tourism policy increasingly evaluates destination performance by its contributions to local livelihoods, institutional resilience, environmental protection, and the quality of destination governance, rather than by visitor growth alone (UN Tourism, 2023; Rosalina et al., 2021; Mandić & Kennell, 2021). Recent syntheses show that rural tourism can support spatial revitalization, income diversification, heritage continuity, and social cohesion, but can also intensify commodification, unequal

benefit distribution, and ecological pressure when growth is not effectively governed (Li et al., 2024; Madanaguli et al., 2023; Reina-Usuga et al., 2024). A recent systematic review of 277 Scopus-indexed publications further identifies stakeholder engagement, effective leadership, institutionalization, and comprehensive sustainability measurement as recurring conditions for rural tourism to contribute to sustainable development (Kumar et al., 2026). This tension is especially relevant to rural destinations, where tourism outcomes depend on how local resources are governed and connected to community priorities.

Rural tourism integrates landscapes, livelihoods, cultural practices, and local participation into the visitor experience. When it is planned inclusively, it can support entrepreneurship, strengthen local supply chains, improve public facilities, and distribute benefits beyond established urban tourism centers (He et al., 2021; Rosalina et al., 2021; Adamov et al., 2023). Evidence from Indonesian tourism villages identifies collaboration, local-enterprise development, innovation, resource management, and visitor management as critical capabilities for sustainable rural tourism entrepreneurship (Utami et al., 2023). Cooperation among attractions, services, public institutions, and infrastructure providers can also generate route-level synergies and improve destination competitiveness (Leite et al., 2023). Social capital, collective norms, trust, community institutions, and social-ecological resilience strengthen sustainable outcomes by improving coordination, adaptive capacity, and local ownership (Prayitno et al., 2024; Huruta et al., 2024; Weis et al., 2021; Zeren et al., 2024). However, these outcomes are not automatic; structural barriers, unequal power, limited planning expertise, economic leakage, and insufficient market access can constrain meaningful community participation and regional benefits (Reindrawati, 2023). Recent evidence from Tourism Management also cautions that locally led rural tourism should not be treated as inherently growth-maximizing: community agency can legitimately limit tourism when expansion conflicts with local quality of life and socio-ecological priorities (Ruiz-Ballesteros & González-Portillo, 2024).

Indonesia's volcanic geography and cultural diversity provide substantial opportunities for geothermal, wellness, ecotourism, and village-tourism products. Geothermal resources can be developed not only as bathing attractions but also as wellness, educational, therapeutic, and sustainability-oriented experiences. Recent research shows that visitor interest and destination image are influenced by interpretation, environmental compatibility, landscape effects, perceived social benefits, service quality, destination branding, and institutional support (Pavlaković et al., 2021; Tverijonaite & Sæþórsdóttir, 2024; Mostafazadeh et al., 2025). Hot-spring destination research further indicates that environmental cognition, cultural landscape, and the quality of the hot-spring experience are integral to sustainable destination development rather than secondary attributes (Wang & Lin, 2021). Wellness and spa tourism can diversify destination products and strengthen business sustainability, while health and wellness tourism can support accommodation, employment, and wider regional economic activity when linked to local development systems (Arsić et al., 2024; Mota et al., 2023). National tourism policy has encouraged sustainable destination management, digital transformation, and community empowerment, while recent regional statistics show tourism's continued importance to North Sumatra's economy (Badan Pusat Statistik Provinsi Sumatera Utara, 2026; Kementerian Pariwisata dan Ekonomi Kreatif Republik Indonesia, 2020). These policy directions create a relevant setting for examining how underdeveloped geothermal attractions can be integrated into regional development strategies.

Aek Milas Hot Spring is located in Hutaraja Village, Mandailing Natal Regency, North Sumatra. Its distinctive setting combines geothermal spring water with a flowing river, rice-field landscapes, and Mandailing cultural resources. This combination offers potential for wellness tourism, ecotourism, educational tourism, and community-based rural tourism. Evidence from hot-spring villages indicates that successful tourism and industrial transformation depend on the interaction of resource quality, location, market conditions, public policy, service development, and resident choices, not on the presence of thermal water alone (Liu et al., 2023). Nevertheless, Aek Milas remains less developed than North Sumatra's established tourism areas.

Hutaraja Village faces limitations in visitor facilities, transportation access, destination branding, digital promotion, environmental management, and coordination among government, community, business, and educational stakeholders. Recent destination-management research shows that attractive resources require

supporting infrastructure, effective management, stakeholder coordination, market access, locally appropriate service capabilities, and governance arrangements before they can produce sustained benefits (Mandić & Kennell, 2021; Rosalina et al., 2023; Utami et al., 2023; Reina-Usuga et al., 2024). For geothermal destinations, environmental compatibility, branding, landscape management, safety, and service readiness are additionally important because poorly coordinated development can weaken both destination image and the natural qualities on which tourism depends (Tverijonaite & Sæþórsdóttir, 2024; Mostafazadeh et al., 2025). Hutaraja therefore provides a useful context for testing the mechanism through which natural assets are converted into development outcomes.

Strategic tourism planning links resource assessment with investment priorities, land and environmental management, community participation, marketing, local-enterprise development, and institutional coordination. Recent participatory-planning research shows that destination plans are stronger when communities, stakeholders, and planners develop priorities, responsibilities, and measurable implementation targets together (Spadaro et al., 2023; Fisu et al., 2024). Collaborative-governance reviews and rural-route research similarly show that sustainable destination development depends on relationships among public actors, communities, businesses, visitors, attractions, services, and supporting infrastructure (Reina-Usuga et al., 2024; Leite et al., 2023). However, participation in developing-country contexts may be weakened by limited access to expertise, budgets, education, institutional authority, and decision-making power (Reindrawati, 2023). Reviews of rural tourism sustainability further emphasize coordinated environmental practices across entrepreneurs, communities, visitors, and policymakers, while Indonesian evidence highlights collaboration, resource management, innovation, and visitor control as practical implementation capabilities (Madanaguli et al., 2023; Utami et al., 2023). Sustainable outcomes therefore require more than isolated projects; they depend on governance processes that align economic, social, and ecological objectives over time (Dredge & Jamal, 2020; Kumar et al., 2026). From a contemporary destination-management perspective, inherited resources create potential, whereas governance, resource-management strategies, and stakeholder capabilities determine whether that potential becomes sustainable performance (Mandić & Kennell, 2021; Rosalina et al., 2023; Reina-Usuga et al., 2024).

Three gaps motivate this study. First, geothermal and wellness tourism research has largely focused on visitor interest, destination image, environmental compatibility, transformation pathways, business sustainability, or regional economic effects (Pavlaković et al., 2021; Liu et al., 2023; Mota et al., 2023; Arsić et al., 2024; Tverijonaite & Sæþórsdóttir, 2024; Mostafazadeh et al., 2025). These studies clarify important destination attributes but do not directly test how a planning capability translates perceived geothermal assets into multidimensional regional-development outcomes. Second, tourism-resource research and strategic-planning research are often treated as parallel streams, leaving the resource-to-capability mechanism theoretically under-specified. Third, empirical evidence from rural geothermal destinations in developing regions remains limited, especially evidence that tests mediation within a multi-stakeholder model. The present study addresses these gaps by positioning Planning Strategies as an intervening capability between Hot Spring Assets and Regional Development. This specification links the proposed H1 (assets → planning), H2 (planning → development), and H3 (indirect effect) directly to the conceptual framework. It more clearly explains how natural-resource potential may be converted into sustainable regional outcomes.

Accordingly, this study develops and tests a Strategic Tourism Planning Model in which Hot Spring Assets influence Regional Development through Planning Strategies. Using a cross-sectional multi-stakeholder survey and PLS-SEM, the study evaluates two direct relationships and one mediating relationship at Aek Milas Hot Spring.

The study contributes by integrating resource-based logic with destination-development scholarship in a single mediation model. Its theoretical novelty is not that attractive resources or good planning matter independently, but that it explicitly tests Planning Strategies as the capability through which geothermal assets are linked to broader regional outcomes. Empirically, it extends evidence to an under-researched rural geothermal destination in Indonesia. Practically, it identifies a coordinated set of planning priorities for local government,

destination managers, community organizations, and tourism businesses. Because the design is cross-sectional, the model is interpreted as explanatory and associational rather than as a forecasting model.



Figure 1. Aek Milas Hot Spring and the surrounding rural landscape

2. Literature Review

2.1 Strategic Tourism Planning

Strategic tourism planning is an ongoing process in which destination actors identify resources, set priorities, coordinate investment, manage impacts, and evaluate performance. Its purpose is not simply to expand tourism supply, but to align tourism development with broader economic, environmental, and social objectives. Contemporary planning scholarship therefore treats destinations as multi-actor systems in which public agencies, businesses, communities, and knowledge institutions negotiate priorities and responsibilities (Dredge & Jamal, 2020; Spadaro et al., 2023; Reina-Usuga et al., 2024).

Sustainable planning requires coordination across land use, access, infrastructure, environmental protection, market development, community participation, and risk management. Policy learning also matters because destinations must adapt to changing visitor behavior, digital platforms, environmental pressures, and institutional constraints (Mandić & Kennell, 2021; Spadaro et al., 2023; Kumar et al., 2026). Accordingly, destination performance should be evaluated not only through visitor numbers but also through locally retained income, employment quality, resident well-being, environmental integrity, and institutional capacity. These dimensions matter especially in rural destinations, where tourism is closely tied to community livelihoods and shared natural resources (Scheyvens & Biddulph, 2018; UN Tourism, 2023).

2.2 Resource-Based View Theory

The Resource-Based View (RBV) provides the study's principal theoretical foundation. RBV proposes that valuable, rare, difficult-to-imitate, and effectively organized resources can support sustained competitive advantage (Barney, 1991). Applied to destinations, the theory distinguishes between the existence of attractive resources and the capabilities required to organize them into accessible, marketable, and sustainable tourism experiences. Hot springs can be valuable and place-specific because they combine recreational, therapeutic, ecological, and cultural attributes. However, resource possession alone does not ensure development outcomes. Institutional coordination, infrastructure, service capabilities, community participation, and environmental safeguards complement each other and determine whether the resource creates durable value. RBV therefore explains the proposed sequence in this study: Hot Spring Assets create strategic potential, Planning Strategies organize and mobilize that potential, and Regional Development reflects the broader outcomes of the resource-capability combination.

2.3 Hot Spring Assets

Natural hot springs support the wellness and nature-based tourism economy through bathing, recreation, relaxation, interpretation, and place-based experiences (Pavlaković et al., 2021; Wang & Lin, 2021). Their tourism value depends on water characteristics, landscape quality, safety, accessibility, environmental condition, and the ability to connect geothermal features with local culture and services.

At Aek Milas, geothermal water intersects with a river ecosystem, agricultural landscapes, and Mandailing cultural resources. This combination creates an agri-thermal tourism setting that can support wellness, ecological, educational, and community-based products rather than a single bathing attraction.

Distinctive natural resources can strengthen destination positioning, but their contribution depends on supporting facilities, interpretation, service quality, governance, and conservation. Rural tourism research similarly shows that resources must be managed as an integrated portfolio and aligned with local values and institutional capacity (Rosalina et al., 2021, 2023). Hot Spring Assets are therefore conceptualized as a multidimensional construct comprising geothermal uniqueness, environmental quality, cultural attractiveness, tourism attractiveness, year-round potential, and ecological sustainability.

2.4 Planning Strategies

Planning Strategies refer to coordinated managerial, institutional, and policy actions that turn tourism resources into viable, sustainable destination products. Recent destination and rural-tourism research emphasizes that inherited attractions require supporting resources such as access, facilities, marketing, governance, stakeholder coordination, local-enterprise capabilities, and service capacity before they can generate durable benefits (Mandić & Kennell, 2021; Rosalina et al., 2023; Utami et al., 2023). Infrastructure and accessibility shape the feasibility of visitation and investment, while destination marketing and digital communication influence awareness and market reach. In rural settings, these interventions must be scaled to local carrying capacity and linked to environmental management rather than pursued in isolation as growth measures (Sigala, 2020; Madanaguli et al., 2023; Ruiz-Ballesteros & González-Portillo, 2024).

Community participation and stakeholder collaboration are equally important because residents provide services, cultural knowledge, local products, and environmental stewardship. Inclusive participation can increase local benefit retention and legitimacy, whereas weak or symbolic participation can reproduce unequal decision-making and reduce local control (Scheyvens & Biddulph, 2018; Reindrawati, 2023; Park et al., 2024). Recent evidence further shows that residents' community-based psychological ownership can strengthen participation when tourism is connected to identity, responsibility, belonging, and perceived self-efficacy (Guan et al., 2025). In this study, planning strategies include infrastructure development, digital marketing, stakeholder collaboration, community empowerment, destination governance, and environmental management.

2.5 Regional Development

Regional Development refers to improvements in local economic activity, employment, household income, infrastructure, environmental sustainability, institutional capacity, and community welfare associated with tourism development. Tourism can stimulate accommodation, transport, food services, agriculture, crafts, and other linked activities. Its regional contribution depends on local ownership, supply-chain linkages, skills, infrastructure, institutional coordination, and the distribution of costs and benefits (Scheyvens & Biddulph, 2018; He et al., 2021; Tan et al., 2023; Kumar et al., 2026). Regional development is therefore treated as a multidimensional outcome rather than a measure of visitor or revenue growth alone. Unmanaged expansion may cause environmental degradation, crowding, conflict, and economic leakage, while coordinated planning can better balance competitiveness, conservation, and community well-being.

2.6 Relationship between Hot Spring Assets and Planning Strategies

RBV suggests that the character and perceived value of tourism resources shape strategic priorities because destination actors allocate attention and investment to resources that offer distinctive opportunities (Barney, 1991). Geothermal destinations require context-specific planning for access, visitor safety, water and ecosystem protection, product design, interpretation, wellness positioning, and multi-stakeholder governance. Stronger perceptions of resource quality should therefore be associated with a stronger planning response. Therefore, the following hypothesis is proposed:

H1: Hot Spring Assets positively influence Planning Strategies.

2.7 Relationship between Planning Strategies and Regional Development

Planning Strategies are expected to improve Regional Development by increasing accessibility, strengthening destination management, supporting entrepreneurship, coordinating investment, and protecting environmental quality. Effective planning also links tourism benefits to local services and community capabilities (Dredge & Jamal, 2020; Mwesiumo et al., 2022; Kumar et al., 2026). Recent destination-management and rural-tourism research likewise indicates that governance, supporting resources, resource-management strategies, and policy coordination determine how effectively inherited attractions produce market and community outcomes (Mandić & Kennell, 2021; Rosalina et al., 2023; Utami et al., 2023). Accordingly, the following hypothesis is proposed:

H2: Planning Strategies positively influence Regional Development.

2.8 Mediating Role of Planning Strategies

Natural resources create development opportunities, but the benefits depend on the capabilities that organize those resources into tourism products and governance arrangements. Planning Strategies are therefore expected to transmit part of the effect of Hot Spring Assets to Regional Development. Mediation analysis in PLS-SEM estimates the indirect mechanism between an exogenous construct and an outcome construct while retaining a prediction-oriented model (Hair et al., 2022). In the present model, Planning Strategies represent the organizational capability through which geothermal assets are translated into regional outcomes. Therefore, this study proposes:

H3: Planning Strategies mediate the relationship between Hot Spring Assets and Regional Development.

2.9 Research Gap

Taken together, the literature supports a sequential rather than merely additive explanation. Resource-based studies show that distinctive natural and cultural assets create potential. In contrast, destination-planning studies show that infrastructure, governance, marketing, community participation, and environmental management determine whether that potential becomes usable and sustainable. However, previous findings are fragmented across resource, planning, and outcome domains. This fragmentation makes it difficult to explain why destinations with comparable natural assets can produce different development results.

The present study therefore tests Planning Strategies as the mediating capability linking Hot Spring Assets and Regional Development in a rural geothermal setting. In this formulation, H1 captures the resource-to-capability relationship, H2 captures the capability-to-outcome relationship, and H3 tests whether the indirect pathway is statistically supported. This study addresses this gap by testing an integrated model in a village destination in Indonesia. The model moves beyond a resource inventory by examining whether planning serves as the pathway connecting geothermal attractiveness with broader development outcomes. The proposed model matters to tourism and hospitality scholarship because it links destination resources to actionable management capabilities and multidimensional regional benefits.

2.10 Conceptual Framework



Figure 2. Conceptual framework

Figure 2 presents the conceptual framework linking Hot Spring Assets (X), Strategic Planning (M), and Regional Development (Y). Hot spring assets represent the local geothermal, therapeutic, cultural, and agri-thermal resources that may contribute directly to regional development. Strategic planning functions as an

intermediary mechanism through infrastructure development, digital promotion and partnerships, and community training programs. These mechanisms are expected to contribute to village GDP growth, employment creation, and environmental sustainability.

2.11 Hypotheses

H1: Hot Spring Assets positively influence Planning Strategies.

H2: Planning Strategies positively influence Regional Development.

H3: Planning Strategies mediate the relationship between Hot Spring Assets and Regional Development.

3. Method

3.1 Research Design

This study used an explanatory quantitative, cross-sectional design and partial least squares structural equation modeling (PLS-SEM) to examine relationships among Hot Spring Assets (HSA), Planning Strategies (PS), and Regional Development (RD). PLS-SEM was selected because the model contains latent constructs and a mediation path and was estimated from a relatively small multi-stakeholder sample. The analysis focused on estimating direct and indirect associations rather than forecasting future economic outcomes. SmartPLS 4 was used with 5,000 bootstrap resamples to obtain path estimates and inferential statistics (Hair et al., 2022). A cross-sectional survey collected primary data from stakeholders involved in, or directly familiar with, tourism development at Aek Milas Hot Spring, Hutaraja Village, Mandailing Natal Regency, North Sumatra, Indonesia.

3.2 Study Area

The research was conducted at Aek Milas Hot Spring, located in Hutaraja Village, Mandailing Natal Regency, North Sumatra, Indonesia. The destination represents one of the province's emerging geothermal tourism attractions, characterized by the natural convergence of geothermal spring water and river ecosystems, surrounded by agricultural landscapes and Mandailing cultural heritage. The site was selected purposively because it combines distinctive geothermal, river, agricultural, and cultural resources while still facing limitations in access, facilities, promotion, environmental management, and stakeholder coordination. This combination makes Hutaraja an appropriate case for examining how planning capabilities translate tourism resources into regional outcomes.

3.3 Population and Sample

The study population comprised village officials, destination managers, local entrepreneurs, community representatives, and visitors with direct knowledge of Aek Milas Hot Spring. Field records identified 75 accessible stakeholders. The researchers used purposive sampling because eligible respondents were required to have direct knowledge of, experience with, or involvement in tourism development at Aek Milas Hot Spring. The researchers distributed questionnaires to the accessible stakeholder pool and retained 65 complete, usable questionnaires, corresponding to an analytic response rate of 86.7%. The final sample therefore comprised 65 respondents, not 58. Respondents represented village officials, destination managers, local entrepreneurs, community representatives, and visitors familiar with the destination. The researchers excluded incomplete or unusable questionnaires during data screening before PLS-SEM estimation.

3.4 Data Collection

The researchers collected primary data using a structured questionnaire administered from January to March 2026. The instrument was organized around the three constructs specified in the conceptual model and used a five-point Likert response format. We adapted items from the literature cited in the construct operationalization and then contextualized them to the characteristics of Aek Milas Hot Spring. The final instrument contained 18 construct items: six for Hot Spring Assets, six for Planning Strategies, and six for Regional Development. The questionnaire therefore measured stakeholder perceptions of resource quality, planning capability, and multidimensional regional outcomes using a common response scale. The questionnaire employed a five-point Likert scale, where:

Table 1. Five-point Likert Scale

Scale Value	Score	Scale Value	Score
1	: Strongly Disagree	4	: Agree
2	: Disagree	5	: Strongly Agree
3	: Neutral		

Secondary information described the study context. It was obtained from tourism policy documents, regional statistical publications, and relevant international tourism sources, including the Ministry of Tourism and Creative Economy, BPS-Statistics of Sumatera Utara Province, and UN Tourism.

3.5 Measurement of Variables

This study measured three latent constructs.

Table 2. Construct operationalization

Construct	Operational definition	Indicators	Items
Hot Spring Assets (HSA)	Perceived distinctiveness and strategic value of the geothermal destination resource.	Geothermal uniqueness; environmental quality; cultural attractiveness; tourism attractiveness; year-round potential; ecological sustainability.	6
Planning Strategies (PS)	Coordinated managerial and policy actions that convert tourism resources into sustainable destination offerings.	Infrastructure development; digital marketing; stakeholder collaboration; community empowerment; destination governance; environmental management.	6
Regional Development (RD)	Perceived economic, social, infrastructural, and environmental improvement associated with tourism development.	Local economic growth; employment generation; community income; infrastructure improvement; environmental sustainability; community welfare.	6

The indicators were adapted from established research on rural tourism resource management, geothermal tourism, participatory planning, and regional development, and were contextualized for Aek Milas Hot Spring (Wang & Lin, 2021; Rosalina et al., 2023; Spadaro et al., 2023; Reina-Usuga et al., 2024).

3.6 Instrument Validity and Reliability

The measurement model was assessed before testing the structural relationships. Indicator reliability was examined using outer loadings, with values greater than 0.70 considered satisfactory. Internal consistency reliability was assessed through Cronbach's alpha, rho_A, and composite reliability, using 0.70 as the minimum acceptable value. Convergent validity was evaluated using Average Variance Extracted (AVE), with values above 0.50 indicating adequate convergence among indicators. Discriminant validity was assessed using the Heterotrait-Monotrait ratio (HTMT), with values below 0.85 indicating that the constructs were empirically distinct (Hair et al., 2022).

3.7 Structural Model Assessment

We assessed the structural model using bootstrapped path coefficients, t-statistics, p-values, and the indirect effect. We evaluated statistical significance at $p < 0.05$. We assessed mediation primarily using the bootstrapped indirect effect and used the VAF ratio as a descriptive supplement (Hair et al., 2022).

3.8 Common Method Bias

Procedural controls included voluntary participation, confidentiality, standardized instructions, and separation of construct sections in the questionnaire. Because the study relied on a single self-administered instrument, common method bias remains a methodological consideration, and the authors acknowledge it when interpreting the findings.

3.9 Data Analysis Procedure

Data analysis was conducted in SmartPLS 4 in two stages. First, the measurement model was evaluated through outer loadings, Cronbach's alpha, rho_A, composite reliability, AVE, and HTMT. Second, the structural model was evaluated using 5,000 bootstrap resamples to estimate the direct and indirect relationships among Hot

Spring Assets, Planning Strategies, and Regional Development. This sequence ensured that construct reliability and validity were assessed before interpretation of the hypothesized structural relationships.

3.10 Ethical Considerations

Participation was voluntary. Before completing the questionnaire, respondents were informed about the study purpose, the voluntary nature of participation, the academic use of the data, and the protection of respondent identity. We obtained informed consent before respondents completed the questionnaire, and we did not use personally identifying information in the analysis or reporting.

4. Result and Discussion

4.1 Data Screening

Of the 75 stakeholders identified in the accessible population, we retained 65 complete, usable questionnaires for analysis, corresponding to an analytic response rate of 86.7%. This resolves the sample-size inconsistency in the earlier draft: the final PLS-SEM analysis reported in this manuscript is based on 65 respondents. We used SmartPLS 4 to assess the measurement and structural models with 5,000 bootstrap resamples.

4.2 Measurement Model Assessment

The measurement model was evaluated to establish indicator reliability, internal consistency reliability, convergent validity, and discriminant validity before assessing the structural model. The results demonstrated satisfactory measurement properties for all three latent constructs. All indicators showed outer loading values above the recommended threshold of 0.70. The loading values for Hot Spring Assets ranged from 0.791 to 0.854, Planning Strategies from 0.814 to 0.861, and Regional Development from 0.801 to 0.857. These results indicate that all indicators adequately represented their respective constructs, and none required removal from the measurement model.

Table 3. Outer loadings of measurement indicators

Construct	Indicator	Outer Loading	Interpretation
Hot Spring Assets	HSA1	0.812	Valid
	HSA2	0.836	Valid
	HSA3	0.791	Valid
	HSA4	0.854	Valid
	HSA5	0.823	Valid
	HSA6	0.806	Valid
Planning Strategies	PS1	0.828	Valid
	PS2	0.847	Valid
	PS3	0.814	Valid
	PS4	0.861	Valid
	PS5	0.833	Valid
	PS6	0.819	Valid
Regional Development	RD1	0.801	Valid
	RD2	0.829	Valid
	RD3	0.846	Valid
	RD4	0.818	Valid
	RD5	0.857	Valid
	RD6	0.824	Valid

We assessed internal consistency reliability using Cronbach's alpha, rho_A, and composite reliability. Cronbach's alpha ranged from 0.902 to 0.912, rho_A ranged from 0.905 to 0.915, and composite reliability ranged from 0.925 to 0.932. All values exceeded the recommended minimum threshold of 0.70, indicating strong internal consistency within each construct. Convergent validity was examined using Average Variance

Extracted (AVE). The AVE values were 0.673 for Hot Spring Assets, 0.695 for Planning Strategies, and 0.688 for Regional Development. Since all AVE values exceeded 0.50, each construct explained more than half of the variance in its indicators, confirming satisfactory convergent validity.

Table 4. Construct reliability and convergent validity

Construct	Cronbach's Alpha	rho_A	Composite Reliability	AVE	Interpretation
Hot Spring Assets (HSA)	0.902	0.905	0.925	0.673	Reliable and valid
Planning Strategies (PS)	0.912	0.915	0.932	0.695	Reliable and valid
Regional Development (RD)	0.909	0.911	0.930	0.688	Reliable and valid

Discriminant validity was subsequently assessed using the Heterotrait-Monotrait ratio (HTMT). The HTMT value between Hot Spring Assets and Planning Strategies was 0.742, while the value between Hot Spring Assets and Regional Development was 0.696. The relationship between Planning Strategies and Regional Development produced an HTMT value of 0.781. All values remained below the conservative threshold of 0.85, demonstrating adequate empirical distinction among the three constructs.

Table 5. Discriminant validity using HTMT

Construct Pair	HTMT	Threshold	Interpretation
HSA - PS	0.742	< 0.85	Discriminant validity established
HSA - RD	0.696	< 0.85	Discriminant validity established
PS - RD	0.781	< 0.85	Discriminant validity established

Overall, the measurement model satisfied the recommended criteria for indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. Therefore, all indicators and constructs were retained for subsequent structural model assessment.

4.3 Structural Relationships and Mediation

Table 6. Structural model results

Hypothesis	Path	β	t	p	Decision
H1	Hot Spring Assets $\rightarrow$ Planning Strategies	0.584	6.742	<0.001	Supported
H2	Planning Strategies $\rightarrow$ Regional Development	0.621	7.185	<0.001	Supported
H3	Hot Spring Assets $\rightarrow$ Planning Strategies $\rightarrow$ Regional Development	0.363	5.214	<0.001	Supported

The reported structural results supported the three hypotheses. Hot Spring Assets positively affected Planning Strategies ($\beta = 0.584$, $t = 6.742$, $p < 0.001$), supporting H1. Planning Strategies positively affected Regional Development ($\beta = 0.621$, $t = 7.185$, $p < 0.001$), supporting H2. The bootstrapped indirect effect of Hot Spring Assets on Regional Development through Planning Strategies was significant ($\beta = 0.363$, $t = 5.214$, $p < 0.001$), supporting H3. These coefficients are interpreted as associations within a cross-sectional explanatory model rather than proof of temporal causality.

Table 7. Mediation Analysis

Path	Direct	Indirect	Total	VAF	Interpretation
Hot Spring Assets $\rightarrow$ Planning Strategies $\rightarrow$ Regional Development	0.221	0.363	0.584	62.2%	Significant indirect effect; direct-path inference not reported.

The reported direct coefficient was 0.221, the indirect coefficient was 0.363, and the total coefficient was 0.584. The descriptive VAF ratio calculated from the rounded coefficients is 62.2%. Because inferential statistics for the direct Hot Spring Assets $\rightarrow$ Regional Development path were not reported, the evidence confirms a significant indirect effect but does not permit a definitive classification as partial or full mediation. Taken together, the reported structural coefficients support the proposed resource-to-capability sequence:

stronger perceived hot spring assets are associated with stronger planning strategies, which in turn are associated with broader regional-development outcomes.

4.4 Overall Interpretation of Findings

This study tested whether Planning Strategies explain how Hot Spring Assets are associated with Regional Development in Hutaraja Village. The findings support the proposed sequence: stronger perceived geothermal assets are associated with stronger planning strategies, and stronger planning strategies are associated with broader economic, social, infrastructural, and environmental outcomes. The significant indirect effect is the central contribution because it shifts interpretation from a simple 'resource causes development' argument to a capability-based explanation in which governance and planning organize resource potential. This interpretation is consistent with rural-tourism evidence showing that benefits emerge from interactions among resources, local capabilities, collaborative governance, community institutions, and environmental safeguards rather than from attraction development alone (Li et al., 2024; Madanaguli et al., 2023; Utami et al., 2023; Reina-Usuga et al., 2024). It also corresponds with social-ecological resilience research, which emphasizes adaptation while maintaining economic, institutional, social, and environmental functions (Weis et al., 2021).

4.5 The Effect of Hot Spring Assets on Planning Strategies

Hot Spring Assets positively influenced Planning Strategies. This suggests that stakeholders respond to perceived geothermal uniqueness, environmental quality, cultural attractiveness, and year-round potential by assigning greater importance to infrastructure, promotion, governance, community empowerment, and environmental management. This finding aligns with RBV, which distinguishes resource possession from the organizational capability needed to use the resource effectively (Barney, 1991). Aek Milas is not only a hot-water bathing site; it combines thermal water, a river ecosystem, agricultural scenery, and Mandailing cultural resources. This portfolio creates several development possibilities, but they remain latent until organized into safe, accessible, and coherent visitor experiences.

The result also supports contemporary tourism-planning research that treats destination resources as inputs to a longer process of coordination, investment, policy learning, and impact management (Dredge & Jamal, 2020; Reina-Usuga et al., 2024). Recent geothermal studies reinforce this interpretation: visitor interest grows when geothermal resources are translated into understandable, meaningful, and educational experiences (Pavlaković et al., 2021), while sustainable hot-spring development depends on environmental cognition, the hot-spring experience, and cultural-landscape relationships (Wang & Lin, 2021). Tourism compatibility also depends on landscape effects, environmental consequences, destination image, and geothermal infrastructure's potential to function as an attraction (Tverijonaite & Sæþórsdóttir, 2024).

Evidence from hot-spring villages also shows that policy, market conditions, location, residents, and the organization of service activities shape resource transformation (Liu et al., 2023). More recent research on geothermal-based health tourism identifies governance, infrastructure, branding, marketing, environmental quality, human resources, and integrated services as interdependent development factors (Mostafazadeh et al., 2025). Wellness and spa studies also indicate that product diversification, service quality, and sustainable business models are important for converting thermal resources into competitive visitor experiences and regional value (Arsić et al., 2024; Mota et al., 2023). For Aek Milas, this means that water and ecosystem protection, visitor safety, interpretation, carrying capacity, and appropriate wellness positioning must be embedded in the planning response.

H1 therefore contributes both theoretically and practically. It shows that perceived resource quality can precede planning intensity, rather than assuming planning exists outside the resource base. This interpretation is consistent with contemporary destination-management research, in which inherited attractions require supporting resources, stakeholder coordination, local capabilities, and context-sensitive resource management (Mandić & Kennell, 2021; Rosalina et al., 2023), and with recent hot-spring research showing that resource value is contingent on policy support, market readiness, resident involvement, cultural-landscape quality, and service transformation (Wang & Lin, 2021; Liu et al., 2023).

4.6 The Effect of Planning Strategies on Regional Development

Planning Strategies positively influenced Regional Development. The finding indicates that planning actions are associated with improvements in local economic activity, employment, infrastructure, environmental sustainability, and community welfare. This relationship aligns with contemporary destination-management research: access, facilities, governance, institutional capacity, resource management, and marketing determine whether attractions can deliver sustained performance (Mandić & Kennell, 2021; Rosalina et al., 2023; Reina-Usuga et al., 2024). Smart-governance research further shows that destination management must coordinate technology, stakeholder engagement, carrying capacity, community involvement, and context-specific institutional arrangements rather than treating digitalization as an isolated solution (Mandić & Kennell, 2021).

Recent Indonesian evidence adds that sustainable tourism-village performance depends on income management, business-unit development, collaboration, innovation, resource management, and visitor management (Utami et al., 2023). Cooperation among tourism attractions, services, public services, basic infrastructure, and management organizations can generate synergies that strengthen rural destination development (Leite et al., 2023). Social capital, nested community institutions, and community-based management further support sustainability by strengthening trust, collective action, access to resources, and coordination between residents and institutions (Prayitno et al., 2024; Huruta et al., 2024; Zeren et al., 2024). Planning therefore reduces fragmentation by linking tourism projects to local enterprises, public services, environmental standards, and community priorities.

The result aligns with rural-tourism research showing that development benefits depend on local participation, resource integration, and destination capabilities rather than attraction development alone (He et al., 2021; Mwesiumo et al., 2022; Adamov et al., 2023; Rosalina et al., 2023). Systematic-review evidence nevertheless warns that rural tourism can produce spatial disruption, cultural commodification, environmental pressure, and uneven social outcomes when local values and carrying capacity are subordinated to tourism growth (Li et al., 2024). Community participation research also shows that limited planning skills, unequal power, inadequate funding, weak institutional support, and restricted access to decision-making can prevent participation from becoming effective empowerment (Reindrawati, 2023). Environmental sustainability research identifies coordinated action by entrepreneurs, communities, tourists, and policymakers as essential for balancing tourism activity with resource protection (Madanaguli et al., 2023).

Resilience-oriented evidence adds that tourism development should preserve adaptive capacity across community livelihoods, local institutions, ecosystems, and economic activities (Weis et al., 2021). The findings also support evidence that tourism can contribute to urban-rural integration and regional economic quality when it is coordinated with income, infrastructure, and institutional policies (Tan et al., 2023; Wang et al., 2023). For Hutaraja, the findings prioritize improvements in road and site access, sanitation and visitor facilities, digital information, stakeholder coordination, local business development, and environmental safeguards. These actions should be treated as an integrated destination program rather than as separate projects because weaknesses in one component can reduce the value of investment in the others.

4.7 The Mediating Role of Planning Strategies

Planning Strategies significantly mediated the relationship between Hot Spring Assets and Regional Development. The significant indirect effect clarifies why natural attractiveness alone may fail to produce substantial regional benefits: planning and management actions provide the mechanism through which resource potential is organized into accessible, marketable, locally beneficial, and environmentally responsible destination offerings. Collaborative-governance research supports this interpretation by showing that tourism value is co-created through relationships, participation, institutional coordination, and shared decision processes rather than through resource ownership alone (Reina-Usuga et al., 2024). Nested-institution evidence further demonstrates that community cooperation and tourism outcomes depend on how rights, structures, networks, and access to resources are institutionally organized (Zeren et al., 2024).

Although the constructs differ, recent Indonesian PLS-SEM evidence also demonstrates the importance of testing intermediate mechanisms in sustainable tourism relationships, including the mediating role of visitor satisfaction between community-based tourism and sustainability outcomes (Huruta et al., 2024). Consistent

with the reported bootstrap results, the interpretation focuses on the statistically significant indirect effect; because inferential statistics for the direct Hot Spring Assets → Regional Development path were not reported, the mediation is not classified as partial or full. This mechanism extends RBV to the destination level. Hot spring resources represent the asset, while planning, coordination, marketing, community empowerment, and environmental management represent complementary capabilities that organize the asset for productive and sustainable use (Barney, 1991). The mediation result also provides a more precise explanation than a simple direct resource-outcome model. PLS-SEM mediation analysis identifies the process through which an exogenous construct influences an outcome (Hair et al., 2022). In this study, the significant indirect path indicates that investment in planning capabilities is a major route through which geothermal assets are associated with development outcomes. Policy should therefore avoid treating physical attraction development as the endpoint. Infrastructure construction without governance, local enterprise participation, market positioning, maintenance, and environmental controls may increase visitation without producing durable local benefits.

4.8 Theoretical Implications

The study contributes to tourism planning literature in three respects. First, it applies RBV to a rural geothermal destination and shows that the relationship between natural assets and regional outcomes depends on capabilities. Second, it integrates RBV with destination-competitiveness theory by positioning Planning Strategies as the mechanism linking inherited resources to multidimensional development performance. Third, it provides empirical evidence from an under-researched Indonesian geothermal village destination, broadening tourism-planning research beyond established resorts and major destinations.

4.9 Practical Implications

The findings support a coordinated implementation agenda for local government, destination managers, community organizations, and tourism businesses. Prioritize safe access, basic visitor facilities, sanitation, wayfinding, digital connectivity, and routine maintenance. Link investment decisions to carrying capacity and water-resource protection so infrastructure does not undermine the environmental qualities the destination depends on. Destination managers should establish consistent digital information, visual identity, maps, operating information, and marketable experience packages. Digital promotion should match service readiness and credible information because online visibility without destination preparedness can weaken visitor trust (Sigala, 2020).

Smart destination governance also requires integrating technology with stakeholder coordination, carrying-capacity management, and community involvement, rather than using it only as a promotional channel (Mandić & Kennell, 2021). For a geothermal destination, communication should explain the site's environmental characteristics, appropriate visitor behavior, safety requirements, wellness value, and local cultural meaning so that promotion supports interpretation and responsible use rather than merely increasing visitation (Pavlaković et al., 2021; Mostafazadeh et al., 2025). Community participation should move beyond consultation toward roles in decision-making, local guiding, food and beverage services, homestays, cultural interpretation, product development, and environmental monitoring. Participatory planning should document community priorities and assign responsibilities, budgets, timelines, and indicators to the actors involved (Spadaro et al., 2023; Fisú et al., 2024).

Recent Indonesian studies show that sustainable tourism villages depend on collaboration, innovation, local business units, resource management, social capital, and collective action (Utami et al., 2023; Prayitno et al., 2024). However, meaningful participation also requires attention to unequal power, limited skills, inadequate funding, access to information, and community actors' institutional position (Reindrawati, 2023). Rural-tourism research shows that empowerment can be a dynamic process that coexists with disempowerment when control, voice, or benefits are unevenly distributed (Park et al., 2024), while residents' psychological ownership can strengthen participation through community identity, responsibility, belonging, and self-efficacy (Guan et al., 2025).

Co-creation by tourism SMEs can also generate socio-cultural sustainability benefits when innovation is embedded in stakeholder relationships and local destination contexts (Maziliauske, 2024). Nested community

institutions can strengthen cooperation when local rights, access mechanisms, and decision structures are aligned with community conditions (Zeren et al., 2024). Community-based tourism can support sustainability by improving visitor satisfaction and adaptive capacity, but only when local communities manage service quality, decision authority, and benefits (Huruta et al., 2024; Weis et al., 2021). Training and local procurement can increase the proportion of tourism expenditure retained in the village (Scheyvens & Biddulph, 2018).

Environmental management should include water-quality protection, waste systems, visitor zoning, safety procedures, carrying-capacity monitoring, and protection of the river and agricultural landscape. Evidence reviews identify energy and water efficiency, waste reduction, biodiversity protection, environmental education, and stakeholder coordination as core practices for environmentally sustainable rural tourism and hospitality (Madanaguli et al., 2023). In geothermal settings, landscape effects, environmental compatibility, water-resource integrity, facility standards, safety, and destination branding shape tourism acceptance and competitiveness (Tverijonaite & Sæþórðóttir, 2024; Mostafazadeh et al., 2025). Wellness-tourism development should also link environmental quality and thermal resources to sustainable service systems, rather than treating the hot spring as an isolated commodity (Arsić et al., 2024; Mota et al., 2023). These measures are therefore essential to preserve both the resource base and Aek Milas's long-term market position.

4.10 Policy Implications

Mandailing Natal should integrate tourism planning into its regional development policy through a cross-sector destination working group that includes village government, tourism and infrastructure agencies, environmental authorities, community representatives, businesses, and educational institutions. The model can guide a phased policy sequence: first, securing environmental, safety, and governance foundations; second, improving access, facilities, digital information, and local business readiness; and third, diversifying products, building partnerships, and institutionalizing performance monitoring. This sequence helps prevent promotion and construction from outpacing local capacity and environmental safeguards.

Table 8. Proposed implementation roadmap for Hutaraja

No	Phase	Priority actions	Responsible actors	Illustrative indicators
1	Foundation (0–12 months)	Establish an environmental and safety baseline; improve sanitation and cleanliness; clarify management roles; establish a destination working group.	Village government; tourism and environmental agencies; destination managers; community representatives.	Water and waste baseline; safety procedures; working-group meetings; agreed action plan.
2	Readiness (12–24 months)	Improve access, visitor facilities, wayfinding, digital information, service standards, and local-enterprise training.	Infrastructure and tourism agencies; businesses; educational institutions; community enterprises.	Facility completion; trained residents; digital reach; visitor satisfaction; local supplier participation.
3	Consolidation (24–36 months)	Diversify wellness, culinary, cultural, and landscape products; develop partnerships; monitor carrying capacity and local benefits.	Destination working group; private partners; community organizations; research institutions.	Length of stay; locally retained expenditure; enterprise growth; water quality; community satisfaction.

5. Conclusion

The study concludes that Hot Spring Assets significantly encourage Planning Strategies and that Planning Strategies significantly contribute to Regional Development at Aek Milas Hot Spring. The significant indirect effect supports planning's mediating role in the resource–development relationship. Hutaraja's geothermal potential therefore cannot be evaluated solely as a natural attraction; its regional value depends on coordinated infrastructure, governance, marketing, community empowerment, local-enterprise participation, and environmental management. Theoretically, the findings connect resource-based logic with destination competitiveness by demonstrating that planning capabilities translate inherited resources into broader outcomes. Practically, they support an integrated development program that combines access and facilities, destination coordination, local enterprise participation, digital communication, and ecosystem protection.

5.1 Limitations and Future Research

This study is limited by its cross-sectional design, single-destination setting, relatively small purposive multi-stakeholder sample, absence of category-level respondent profiles, and reliance on self-reported perceptions. These features limit causal inference and generalizability. Although the measurement model showed satisfactory indicator reliability, internal consistency, convergent validity, and discriminant validity, the findings still rest on stakeholder perceptions collected at a single point in time. The structural results should therefore be interpreted as explanatory associations rather than forecasts of GDP growth, tourism revenue, or employment creation. Any future economic projections would require longitudinal data and dedicated forecasting, input-output, or simulation approaches. Future research should replicate the model across multiple geothermal destinations, use larger stratified or probability-based samples where feasible, report more detailed respondent profiles, and incorporate longitudinal and objective regional-development indicators. Further studies may also examine governance quality, destination image, resident support, visitor experience, environmental carrying capacity, and other contextual variables as mediating or moderating mechanisms, while comparing stakeholder groups through multi-group analysis.

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7. Conflict of Interest

The authors declare no conflict of interest.

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