

(Research/Review) Article

Model for Optimizing the Development of Aek Sijorni Natural Bath Tourism in South Tapanuli Regency

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Abstract: The Aek Sijorni Natural Bath in South Tapanuli Regency holds great potential as a regional tourism icon, with its tiered waterfalls and unique natural atmosphere. This study aims to formulate a model for optimizing tourism development based on sustainability, technology, and local community participation. A mixed methods approach was employed. The findings indicate that development of the area should focus on improving basic infrastructure, enhancing cleanliness, and providing additional facilities such as dining areas and recreational zones. Furthermore, strengthening digital promotion and actively involving the local community are proven to be key factors in creating a competitive and sustainable destination. Strategic recommendations are centered on multi-stakeholder collaboration and the use of information technology to generate broader economic and social impacts for the surrounding communities.

Keywords: Aek Sijorni; Optimization; Tourism Development.

1. Introduction

Aek Sijorni Natural Bath is one of the nature-based tourist destinations located in South Tapanuli Regency. Its main attractions include a tiered waterfall, crystal-clear water, and a well-preserved natural atmosphere. Since gaining broader recognition in 2013, the area has become a popular recreational site for both local and out-of-town visitors. However, its management has not yet been fully optimized. Access to the location remains limited, consisting only of footpaths that make it difficult for four-wheeled vehicles to enter (Aris & Nuraini, 2024; Nuraini et al., 2023). Supporting facilities such as parking areas, restrooms, and information boards are also very limited (Lukoseviciute et al., 2024). In addition, the lack of digital promotion and the absence of an online-based tourism service system make it difficult for potential tourists to obtain information about the destination (McCarroll et al., 2024; Phan et al., 2021).

These conditions indicate a gap between the site's high tourism potential and the still-conventional management capacity. Previous studies emphasize that the development of nature-based tourism destinations heavily depends on governance that incorporates technology, community participation, and sustainability principles (Tarigan et al., 2023). A community-based tourism model, such as the one developed by Setiawan et al. (2022) in McCarroll et al. (2024), shows that active involvement of the local community greatly contributes to the success of a destination. Moreover, the integration of digital technologies, such as online booking apps and digital promotions, has been proven to enhance visitor experience and management efficiency (Smith & Robinson, 2023 in Knowles & Scott, 2024). Meanwhile, an ecotourism approach that balances environmental, social, and economic aspects is considered the most relevant strategy for natural areas like Aek Sijorni (Pratama et al., 2023 in Lukoseviciute et al., 2024; Rahman & Nuraini, 2024).

In response to these conditions, this study aims to answer the main research question: how can a sustainable development optimization model be designed for Aek Sijorni Natural Bath that is adaptive to current challenges, local characteristics, and technological developments? This research seeks to formulate tourism development strategies that can enhance the competitiveness of the area while simultaneously creating sustainable economic, social, and

Received: May 30, 2025;

Revised: June 30, 2025;

Accepted: July 12, 2025;

Published : July 30, 2025

Curr. Ver.: July 30, 2025



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environmental value. The findings of this study are expected to serve as a policy reference for local governments, tourism stakeholders, and community groups in creating an inclusive, innovative, and impactful destination for the welfare of the surrounding community.

2. Preliminaries or Related Work or Literature Review

Nature-Based Bath Tourism

Nature-based bath tourism is a form of ecotourism that utilizes water resources such as springs, rivers, and waterfalls, offering recreational, health, educational, and ecological value. When managed sustainably, this type of tourism contributes to the well-being of local communities.

Law No. 10 of 2009 states that tourism aims to improve public welfare, preserve nature, and promote culture. Natural baths fall under natural tourist attractions as mentioned in Article 14 paragraph (1) letter a, which includes the uniqueness and beauty of nature, flora, and fauna.

According to UNWTO (2022) in Rahman and Nuraini (2024), sustainable tourism aims to maximize social and economic benefits while minimizing environmental and cultural impacts. Its core principles include nature conservation, community participation, and economic empowerment through inclusive tourism management.

Tourism Development

Tourism development is a strategic process involving planning, management, and evaluation to create attractive, competitive, and sustainable destinations. Its objectives are not only to increase tourist visits but also to strengthen the local economy, preserve the environment, and sustain cultural heritage.

Government Regulation No. 50 of 2011 on the National Tourism Development Master Plan (RIPPARNAS) serves as the national guideline for tourism development through 2025. This document emphasizes development based on local potential and sustainability principles, as well as the alignment of development strategies with the socio-economic and geographical characteristics of the community (Tarigan et al., 2021).

Key factors in destination development include accessibility, attractions, amenities, promotion, and community involvement. In the context of Aek Sijorni, the availability of supporting facilities and digital promotion must be improved to maintain consistent tourist visits. Community participation is also a key to successful sustainable development, especially in responding to land-use dynamics (Tarigan et al., 2021).

A participatory approach is relevant, in which area management should align with local conditions to avoid conflicts between economic interests and environmental conservation (Milanie, 2024). The local government plays a vital role as facilitator and regulator, while collaboration between government, private sector, and communities is essential to build a sustainable and inclusive destination.

Optimization Models

Optimization models in tourism development aim to enhance the effectiveness and efficiency of destination management to maximize and sustain benefits. These models integrate various approaches such as economic, social, environmental, and public policy dimensions.

SWOT Model (Strengths, Weaknesses, Opportunities, Threats): This model is used to analyze the internal and external factors influencing tourism development. According to Tarigan (2023), internal strengths such as natural resources serve as a strong foundation for developing local potential based on flagship commodities. By understanding these factors, managers can formulate the most suitable strategy to advance Aek Sijorni tourism.

Pentahelix Model: This model involves five main elements: government, academia, business actors, community, and media. It is suitable for collaborative tourism development such as in Aek Sijorni, which requires synergy among stakeholders.

Community-Based Tourism (CBT): This model emphasizes the active role of local communities in planning, managing, and benefiting from tourism activities. CBT is especially relevant for rural and nature-based tourism development.

Carrying Capacity Model: This model calculates the environmental capacity to ensure the number of visitors does not exceed the ecological limits of the area. It is essential to prevent environmental degradation of natural bath sites.

Sustainable Tourism Development Model: This model integrates sustainability principles throughout the entire development process, from planning to monitoring, aiming to ensure tourism longevity without harming ecosystems or local socio-cultural values.

Utilizing these models enables tourism managers to select the most appropriate approach based on local conditions and the specific development goals for Aek Sijorni. Milanie (2023) emphasizes that development should be tailored to local characteristics and involve synergy between the government, private sector, and community to achieve regional sustainability. This principle supports an inclusive, community-based tourism development model as exemplified by Aek Sijorni.

Comparison with Previous Studies

To obtain a more comprehensive understanding of natural bath tourism management and development in Indonesia, a comparative analysis was conducted between Aek Sijorni Natural Bath and several other natural bath destinations previously studied in scientific research. This comparison is based on five key aspects: water sources, accessibility, visual attraction (view), management type, and the availability of academic references. The results of the comparison are presented in Table 2.1 below:

Table 1. Comparison of Natural Bathing Sites Based on Academic Studies

No	Site / Study	Water Source	Accessibility	View / Attraction	Management	Academic References
1	Aek Sijorni Natural Bathing Site (this research)	Mountain spring	Village road + local transport	Clear water, lush trees on hillside	Local government & community	—
2	Umbul Pongkok (Klaten)	Natural spring	Main road, spacious parking area	Snorkeling pool & underwater photography	Village-owned enterprise (BUMDes) & local community	Rahoyo & Slahanti (2022); Wahyuni et al. (2023); Satriawati et al. (2019)
3	Cangar Hot Spring (Batu City)	Natural hot spring	Mountain road, tourist area	Protected forest, sulfuric hot springs	Tahura UPT / Batu City Government	Zaman (2011); Hanik Fikri (2013); Sulistyono (2016); Pratama (2023)
4	Karang Anyar Natural Bathing Site (Simalungun)	Mountain spring	Village road	Natural pool + mountain forest atmosphere	Regency government & local community	Pertiwi & Putra (2023); Sasmita (2017)

No	Site / Study	Water Source	Accessibility	View / Attraction	Management	Academic References
5	Damai Wisata Bathing Site (West Sumatra)	Mountain spring	District road, parking available	Public pools, basic family tourism facilities	Local government & local private sector	Sakti & Manvi (2023)

Source: Researcher, 2025

The table above presents a comparison of five natural bath destinations, each of which has been examined in academic studies. All five share a fundamental similarity in being based on natural spring water sources, yet they exhibit variation in terms of management, accessibility, and tourist appeal.

The first site used for comparison is **Umbul Ponggok** in Klaten, Central Java, which serves as a successful example of community-based tourism development through active management by the village-owned enterprise (BUMDes). Its success lies not only in the clarity of its water—an attraction for snorkeling—but also in its participatory and transparent management system, which has effectively built a local economic ecosystem (Rahoyo & Slahanti, 2022). The applied strategy includes digital promotion integration, enhancement of local human resources, and the development of artificial attractions to increase destination competitiveness (Wahyuni et al., 2023). Meanwhile, Satriawati et al. (2019) emphasize the importance of fully integrating tourism potential with village resources as the foundation of sustainability. The case of Umbul Ponggok provides valuable insights into the importance of strong institutional structures in developing spring-based tourism destinations.

The next destination is **Cangar Hot Spring** in Batu City, East Java, located within the conservation area of R. Soerjo Grand Forest Park (Tahura). Although geographically different, the site is relevant due to its similar reliance on natural water resources and the pressure of high tourist volumes. Zaman (2011) highlights the geothermal potential and its implications for site management, while Hanik Fikri (2013) explores comfort and safety aspects from the tourist perspective. Sulisty (2016) adds that improvements in infrastructure and environmental carrying capacity are crucial. Most recently, Pratama (2023) emphasized the need for calculating the site's carrying capacity to prevent ecological degradation. With its strong conservation-based approach, Cangar provides a vital precedent for Aek Sijorni, which is beginning to experience a surge in visitors.

Next, **Karang Anyar Natural Bath** in Simalungun, North Sumatra, serves as a contextual comparator as it is located within the same province as Aek Sijorni. According to Pardede (2015), this site is still managed in a traditional manner with minimal institutional involvement, despite active efforts by the local community to maintain cleanliness and natural ambiance. Pertiwi and Putra (2023) stress the need for capacity building, local branding, and digitalization as prerequisites for transforming the destination into a competitive one. The situation at Karang Anyar reflects similar challenges to those at Aek Sijorni, especially regarding management capacity and the role of local government involvement.

The final object of comparison is **Damai Wisata Natural Bath** in West Sumatra, examined by Sakti and Manvi (2023) using a quantitative approach. Their study shows that cleanliness of facilities, availability of prayer spaces, parking areas, and informational signage significantly affect tourist satisfaction and revisit intentions. In the context of Aek Sijorni—where basic facilities are still lacking—these findings reinforce the notion that consistent and quality services are critical for the success of nature-based tourism development.

The comparative findings show that successful development of natural bath tourism relies on synergy between natural attraction quality, institutional governance, community participation, and basic facility provision. Tarigan and Taufik (2023) studied community empowerment through productive yard management in rural areas. Their findings show that local participation can significantly contribute to economic growth and regional sustainability—aligning with the community-based tourism approach adopted in this study.

Aek Sijorni possesses strong landscape and water resource potential but remains weak in formal management, digital promotion, and supporting infrastructure. Lessons from Umbul Ponggok highlight the importance of local institutions and tourism product innovation, while Cangar provides a framework for conservation policy and visitor capacity control. The

studies of Karang Anyar and Damai Wisata emphasize the role of community involvement and adequate facilities in creating a sustainable tourism experience.

This comparison indicates that successful tourism development cannot rely solely on natural potential, but must be supported by inclusive management models, adequate infrastructure, digital strategies, and a clear understanding of environmental carrying capacity. By adapting best practices from previous studies to local characteristics, Aek Sijorni has the potential to evolve into a leading sustainable tourism destination.

Tourism Standards and Natural Attraction Criteria

The development of tourism destinations such as natural bath sites must adhere to both national and international standards regarding quality and sustainability. In Indonesia, one of the primary references is the Indonesian National Standard (SNI) 8379:2018, which regulates Natural Tourism Attractions. This standard includes four key components: (1) Accessibility, (2) Attraction, (3) Amenities (supporting facilities), and (4) Safety and Comfort (BSN, 2018). In addition to SNI, another crucial regulation is Government Regulation No. 50 of 2011 concerning the National Tourism Development Master Plan (RIPPARNAS), which emphasizes development based on local potential and sustainability. Key points of this regulation include the importance of community empowerment, multi-stakeholder involvement, and alignment with environmental carrying capacity (Kemenparekraf, 2011).

At the global level, the United Nations World Tourism Organization (UNWTO) defines sustainable tourism as “tourism that fully considers its current and future economic, social, and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities” (UNWTO, 2022). The implementation of this standard emphasizes indicators such as: (1) Conservation of nature and culture, (2) Local community participation, (3) Waste and energy management, and (4) Technological innovation and digitalization of services. Therefore, the development of Aek Sijorni Natural Bath must align with these standards, particularly in strengthening its attraction, enhancing conservation-based facilities, and utilizing digital technology for tourism promotion and service delivery.

Conceptual Framework of the Study

Based on the literature review and previous empirical studies, this research constructs a conceptual framework that illustrates the relationships between key variables in the development of nature-based tourism. The five independent variables examined are natural beauty, cleanliness, supporting facilities, accessibility, and tourism promotion. These variables are assumed to influence tourist satisfaction and revisit intention, which serve as the dependent variables. In addition, the dimensions of digitalization and local community participation are identified as strengthening elements in the optimization of destination management.

The structure of the relationships between these variables serves as a reference in the analysis and formulation of a sustainable and competitive tourism development model. The relationship between elements in this study is presented in **Figure 1**.

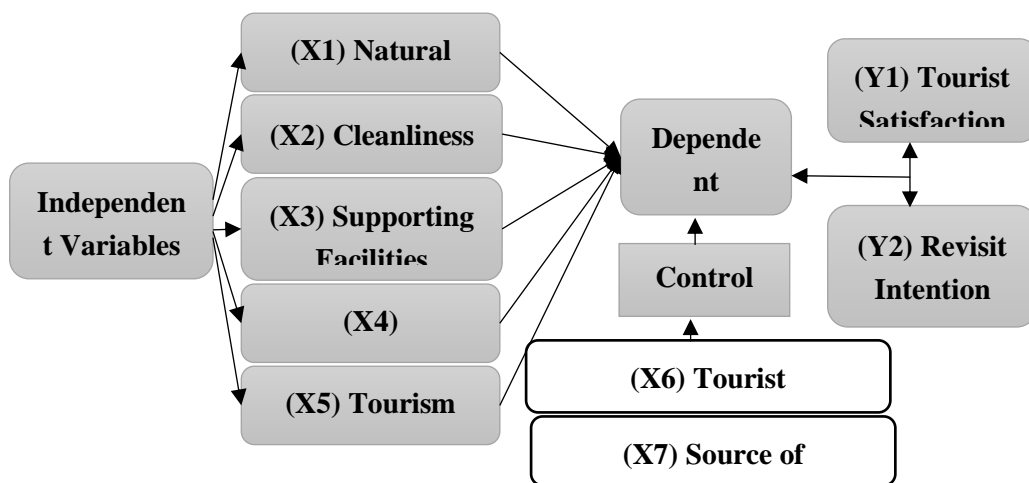


Figure 1. Conceptual Framework of the Research
 Source: Researcher, 2025

In this study, a systematic approach is employed to formulate an optimization model for the development of Aek Sijorni Natural Bath tourism. By addressing key challenges such as accessibility, cleanliness, supporting facilities, and local community involvement, this research is designed to integrate both quantitative and qualitative methods to produce comprehensive insights (Suprianto & Nuraini, 2024). The research stages begin with identifying problems that hinder the optimization of the tourism area, followed by data collection from various sources to gain in-depth information regarding tourist perceptions, facility conditions, and area management. The data is then analyzed thoroughly to reveal patterns emerging from quantitative data and to understand context through qualitative findings. The detailed stages of the research process are presented as follows:

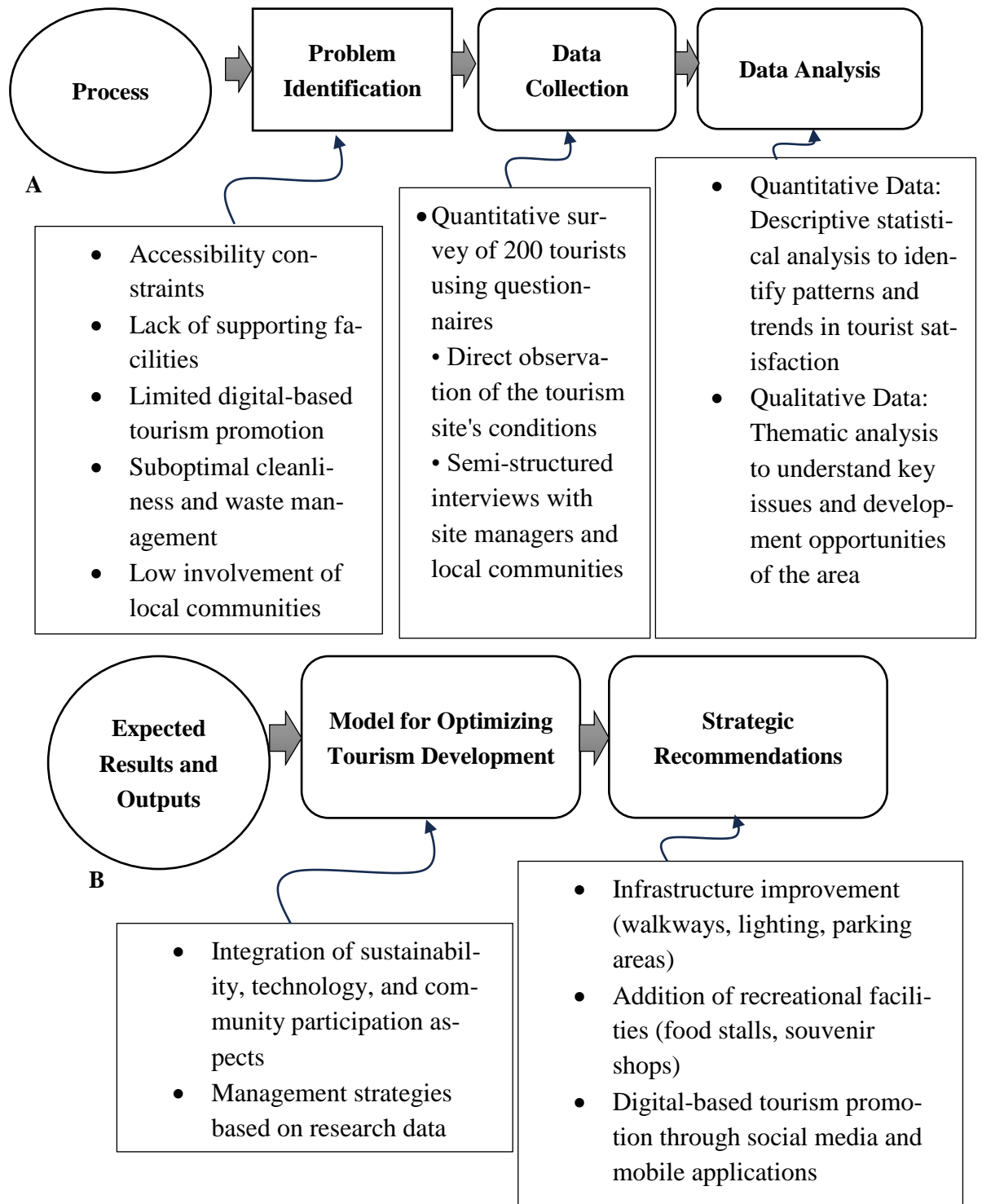


Figure 2. (A), (B) The Research Process
 Source: Researcher, 2025

3. Proposed Method

This study adopts a mixed methods approach, combining both qualitative and quantitative methods to obtain a holistic understanding of the development of the Aek Sijorni Natural Bath tourism area. The quantitative approach is used to measure tourists' perceptions of variables such as natural beauty, cleanliness, supporting facilities, accessibility, and tourism promotion. Meanwhile, the qualitative approach is employed to explore the perspectives of local stakeholders through in-depth interviews and field observations, in order to understand the social dynamics and potential for community empowerment in managing the area (Siregar et al., 2023).

Primary data were collected through the distribution of questionnaires to 200 tourists visiting Aek Sijorni, using purposive sampling to ensure the representation of tourist experiences. Interviews were conducted with representatives of the local government, site managers, and surrounding communities. Observations were carried out directly on physical conditions such as access routes, public facilities, and local economic activities (Hidayat et al., 2023). The study was conducted in South Tapanuli Regency between November 2024 and March 2025.

Quantitative data were analyzed descriptively using statistical software to identify trends in tourist perceptions and satisfaction levels. Meanwhile, qualitative data were analyzed using a thematic analysis approach, extracting key issues from interviews and observation notes. The combined results of both analyses form the basis for developing an optimization model for tourism development based on sustainability, technology, and local community participation (Fachrudin & Lubis, 2016; McKercher & Tkaczynski, 2024).

4. Results and Discussion

Natural bath sites such as Aek Sijorni hold considerable potential thanks to their unique geography and rich biodiversity. Its strategic location and good overall accessibility add further appeal for both domestic and international visitors. To ensure that the resulting benefits are felt by surrounding communities, however, this potential must be developed professionally. Earlier studies—among others, Fachrudin & Lubis (2016), McCarroll et al. (2024), and Phan et al. (2021)—stress the importance of local-community involvement and the adoption of a Community-Based Tourism (CBT) model, which can simultaneously raise community welfare and safeguard the environment.

Technology also plays a decisive role in modern tourism development. As Smith and Robinson (2023) note in Pásková et al. (2024), integrating technology—such as visitor apps, online reservation systems, and social media—can boost tourism promotion and the overall visitor experience. Technology likewise enables more efficient management through visitor-data collection and e-ticketing systems. In Aek Sijorni's context, such integration can help overcome problems such as limited promotion and information access; Aris & Nuraini (2024) and Rahman & Nuraini (2024) found that using digital tools at nature-based destinations can increase annual visitor numbers by up to 30 percent.

Other success factors include accessibility, supporting facilities, effective promotion, and environmental preservation (Yulianti et al., 2022 in Nuraini, 2024; Situmorang, 2024). As Sugiarto (2024) points out, natural potential must be managed through risk-mitigation measures and environmental carrying-capacity limits to prevent ecological damage during regional development. For natural baths, over-exploitation and pollution must be avoided to keep the resource intact. Community-based initiatives—in tourism as well as agriculture—require an integrated approach that combines sustainable resource use, human-resource capacity building, and multi-stakeholder collaboration (Tarigan et al., 2023).

Local residents' role is equally critical. Tarigan et al. (2021) showed that regional development succeeds when communities can respond to land-use change through structured empowerment programs. Active involvement fosters a sense of ownership and environmental responsibility while ensuring a fair distribution of economic benefits.



Figure 3. Research Location

Source: Wahyudi (photographer), Researcher's Observation, 2024

Geographically, the site is easy to reach from downtown Padangsidempuan, but greater attention is still needed regarding the final approach to the main area. Visitors must walk along a fairly challenging footpath and, in some cases, hire motorcycle taxis to reach the baths. This poses an obstacle for tourists arriving in private cars or those with specific accessibility needs.

To design an optimization model for developing Aek Sijorni Natural Bath, this study surveyed 200 tourists and conducted direct observations of site conditions. The data collected were analyzed in relation to the predetermined variables: natural beauty, cleanliness, supporting facilities, accessibility, tourism promotion, tourist satisfaction, and revisit intention. Each variable is described in detail below to provide a comprehensive understanding of the site's current status.

Table 2. Satisfaction Level Regarding Natural Beauty

Satisfaction Level	Number of Respondents	Percentage (%)
Very Satisfied	150	75
Satisfied	30	15
Dissatisfied	20	10

Source: Researcher's Tabulation, 2024

From the table above, it can be seen that the majority of respondents (75%) stated that they were very satisfied with the natural beauty of the Aek Sijorni Natural Bath. The main attractions—tiered waterfalls and the preserved natural atmosphere—were the primary reasons for tourist visits. However, 15% of respondents indicated that they were satisfied with notes, stating that the surrounding area should be better organized to maintain the site's natural aesthetics. The remaining 10% of respondents were dissatisfied, citing the presence of litter in several areas, which detracted from the site's natural impression. This finding highlights the need for improved cleanliness management to support the area's appeal. The next variable, Cleanliness, is described as follows:

Table 3. Satisfaction Level Regarding Cleanliness

Satisfaction Level	Number of Respondents	Percentage (%)
Very Satisfied	60	30
Satisfied	80	40
Dissatisfied	60	30

Source: Researcher's Tabulation, 2024

The cleanliness of facilities at Aek Sijorni received mixed responses. 40% of respondents stated that they were satisfied, while 30% were very satisfied, particularly with the cleanliness of the main bathing area. However, the remaining 30% were dissatisfied, citing issues such as mossy and poorly maintained toilets. These findings highlight the importance of regular maintenance to ensure the cleanliness and hygiene of the area are well preserved. The next variable, Supporting Facilities, is presented as follows:

Table 4. Satisfaction Level Regarding Supporting Facilities

Satisfaction Level	Number of Respondents	Percentage (%)
Very Satisfied	20	10
Satisfied	60	30
Dissatisfied	120	60

Source: Researcher's Tabulation, 2024

Supporting facilities such as toilets, parking areas, and family recreation zones were the most frequently criticized aspects. A total of 60% of respondents expressed dissatisfaction, citing the lack of adequate facilities and poor maintenance conditions. Respondents recommended the addition of amenities such as food stalls, souvenir shops, and children's play areas to improve overall visitor comfort.

The next variable, Accessibility, is described as follows:

Table 5. Level of Satisfaction with Accessibility

Satisfaction Level	Number of Respondents	Percentage (%)
Very Satisfied	10	5
Satisfied	70	35
Dissatisfied	120	60

Source: Researcher's Tabulation, 2024

As many as 60% of respondents expressed dissatisfaction with the accessibility to the location. The main complaints were the footpaths that are difficult to pass and inadequate for four-wheeled vehicles. Infrastructure improvement, particularly the construction of proper access roads to the site, is the main recommendation from visitors. The Tourism Promotion variable shows:

Table 6. Tourist Information Sources

Information Source	Number of Respondents	Percentage (%)
Friend's Recommendation	100	50
Social Media	60	30
Brochures/Posters	40	20

Source: Researcher's Tabulation, 2024

Survey results show that tourism promotion has not been maximized. A total of 50% of respondents learned about this location through recommendations from friends, 30% through social media, and the remaining 20% through other sources such as brochures or posters. Digital-based promotion needs to be intensified to reach more potential visitors. The next variable is Tourist Satisfaction, with the following results:

Table 7. Tourist Satisfaction Level

Satisfaction Level	Number of Respondents	Percentage (%)
Very Satisfied	70	35
Satisfied	90	45
Dissatisfied	40	20

Source: Researcher's Tabulation, 2024

Tourists' satisfaction with their overall experience at Aek Sijorni varies. As many as 45% of respondents stated that they were satisfied, 35% were very satisfied, and 20% felt dissatisfied. These results indicate the need for improved service quality to ensure visitors have an optimal experience. The final variable refers to the Revisit Intention, as follows:

Table 8. Revisit Intention

Revisit Willingness	Number of Respondents	Percentage (%)
Willing	90	45
Doubtful	70	35
Not Interested	40	20

Source: Researcher's Tabulation, 2024

As many as 45% of respondents stated that they would be willing to return if accessibility and facilities were improved. However, 35% were still doubtful, and 20% stated that they were not interested in returning. Survey and interview results indicate that natural beauty is the main attraction of Aek Sijorni.

As part of this research, visual documentation is included to provide a real depiction of the current condition of the Aek Sijorni Natural Bath. This documentation aims to support research findings, especially those related to accessibility, supporting facilities, cleanliness, and main tourism attraction elements.

The photos presented were taken directly by the researcher during the data collection process through field observation. These images not only illustrate the physical condition of the tourist area but also provide visual context that helps in understanding the challenges and opportunities in managing the Aek Sijorni tourist destination. The following is the documentation collected during the research:

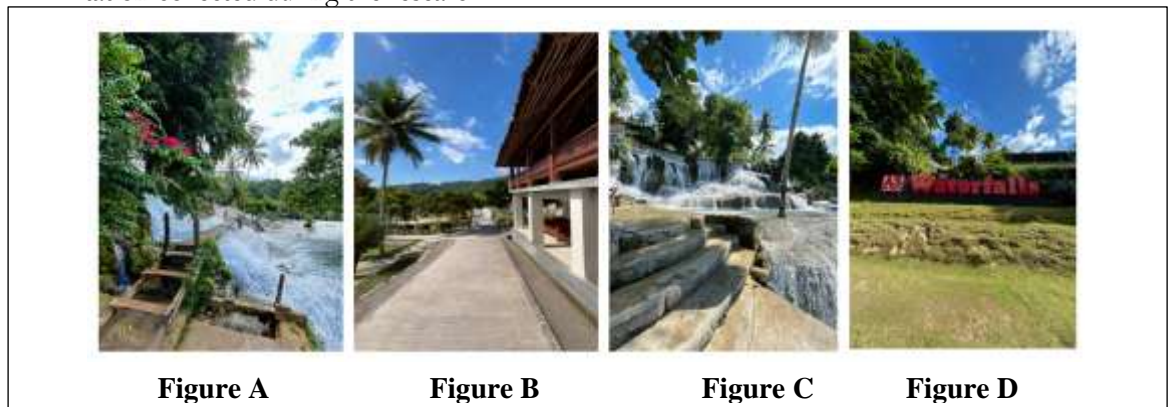


Figure 4. Further Research Location

Source: Researcher's Observation, 2024

Figure A shows a pathway that connects several parts of the tourist area. This path is located near the waterfall and utilizes natural materials such as wood. However, it appears poorly maintained, with signs of decay and moss, which may increase the risk of slipping for visitors. Although it adds to the site's natural aesthetics, the path requires significant improvements to ensure tourist safety and comfort. This condition aligns with the survey findings, which indicate that accessibility is one of the main challenges.

Figure B displays a paved walkway that provides better access for visitors. However, the path appears narrow and inadequate to accommodate a large number of tourists, especially during holiday seasons. Additionally, the walkway lacks supporting elements such as sufficient lighting and rest areas. This trail is a crucial infrastructure element that needs further development to enhance accessibility in the tourist area.

Figure C presents Aek Sijorni's main attraction: a unique, multi-tiered waterfall. The waterfall structure looks natural, with clear water flowing through it. The visual beauty of this waterfall is the primary draw for visitors, as reflected in the survey where 75% of respondents expressed high satisfaction with the natural beauty of the site. However, the area surrounding the waterfall appears to require additional infrastructure to support comfort—such as safer pedestrian paths and recreational facilities.

Figure D features a large sign reading "AS Waterfalls," which serves as the site's identity marker. While the sign is quite prominent and functions as a promotional tool, its location—detached from the main waterfall area—reduces its effectiveness in conveying information to visitors. A more integrated promotional strategy, including the placement of additional information boards in key locations, would better assist tourists in understanding the available facilities.

Survey and interview results confirm that natural beauty is Aek Sijorni's main attraction, as illustrated in the site visuals. However, difficult access and limited supporting facilities,

such as unsafe pathways and a lack of rest areas, reinforce respondents' complaints about the area's infrastructure conditions. The site's branding efforts show an attempt at promotion, but they are not yet fully optimized, given that many visitors learn about the location through word-of-mouth recommendations.

Improving infrastructure, cleanliness, and supporting facilities should be prioritized, including the addition of amenities like food stalls and souvenir shops to meet tourist needs. Digital tourism promotion must also be strengthened to expand market reach, while local community involvement in area management can create positive impacts for the destination's sustainability.

Discussion

The research findings indicate that Aek Sijorni Natural Bath holds significant potential as a leading tourist destination, primarily due to its captivating natural beauty. Figure C illustrates the main attraction of the site—tiered waterfalls with clear flowing water—which is the primary reason for tourist visits. This is reflected in the survey, where 75% of respondents stated they were very satisfied with the natural scenery. These findings are consistent with previous studies showing that tourists tend to choose destinations with strong natural elements as their main motivation for visiting (DeMaagd et al., 2022; Fachrudin & Lubis, 2016), as seen with the tiered waterfalls of Aek Sijorni. The importance of infrastructure and supporting facilities, such as toilets, parking areas, and family recreational spaces, is also emphasized in studies by McKercher & Tkaczynski (2024), as these are still considered inadequate in the area.

Observations on the limited availability of sanitation and clean water facilities at Aek Sijorni align with Milanie's (2023) approach, which developed sensor- and algorithm-based technologies to improve clean water distribution systems in urban areas. A similar strategy could be adapted to nature-based tourist destinations.

However, the study also reveals several critical issues, especially regarding infrastructure conditions. Figures A and B show wooden pathways that are deteriorating and covered in moss, posing safety risks for visitors. The existing paved paths are also narrow and insufficient to accommodate high tourist volumes, especially during holiday seasons. These findings highlight the need for improved walkways, additional lighting, and rest areas to enhance visitor comfort and safety.

Supporting facilities in the area are still basic. Sixty percent of respondents expressed dissatisfaction with the current condition of toilets, parking spaces, and family recreational areas. Suggestions from respondents and local stakeholders include the addition of restaurants, souvenir shops, and children's play areas to improve the overall visitor experience.

On the other hand, promotional efforts are still suboptimal. Figure D shows a signboard labeled "AS Waterfalls" serving as a form of branding. However, its placement is not strategic, and the lack of supporting information makes it less effective. Half of the respondents learned about Aek Sijorni through word-of-mouth recommendations, while only 30% learned about it through social media. This highlights the urgent need for a more integrated digital marketing strategy to expand the destination's visibility. These findings align with McCarroll et al. (2024), who found that online and social media-based promotions significantly increase tourist visits.

Dissatisfaction with the overall tourist experience at Aek Sijorni stems largely from difficult access, lack of cleanliness, and inadequate facilities. Repeat visitation intent data also reflects this, with 45% of respondents stating they would return if access and facilities were improved, 35% expressing uncertainty, and 20% unwilling to return. This contrasts with findings by Iasha et al. (2015), which suggested that accessibility had no significant impact on tourists' decisions to visit natural destinations. In contrast, this study demonstrates that accessibility is one of the main factors influencing visitor satisfaction and return intention.

Furthermore, the promotional strategy must be improved. Although Fachrudin & Lubis (2016) and McKercher & Tkaczynski (2024) argued that large-scale events are more effective than digital promotions, this study suggests that digital marketing is more urgent to increase Aek Sijorni's attractiveness in a broader tourism market. By maximizing natural beauty as the main potential, supported by infrastructure development, improved services, and integrated digital marketing, Aek Sijorni can evolve into a competitive and sustainable tourism destination on both regional and national levels.

When compared to previous studies, the findings of this research reflect similar patterns and development potentials as other natural bathing sites studied in Indonesia. For example, limited accessibility at Aek Sijorni, which relies on rural roads and two-wheeled vehicles, mirrors initial conditions at Karang Anyar Natural Bath (Sasmita, 2017; Pertiwi & Putra, 2023).

Both face infrastructure challenges and lack adequate location information systems, which hinder tourist potential.

This differs from Umbul Ponggok in Klaten, which underwent a successful transformation after being professionally managed by the local village-owned enterprise (BUMDes Tirta Mandiri). With strong local institutional support, access was improved, parking areas were expanded, and digital promotions were enhanced. Rahoyo & Slahanti (2022) and Wahyuni et al. (2023) highlighted the integration of local institutions and attraction innovation (e.g., underwater photography) as key to the success of this water-based destination.

Lessons can also be drawn from Cangar Hot Springs in Batu City, located within a forest conservation area. Pratama (2023) emphasized the importance of calculating carrying capacity to prevent ecological damage from excessive tourist visits. Zaman (2011) and Sulistyono (2016) also noted the importance of conservation-based management. As tourist numbers to Aek Sijorni continue to grow, the concept of carrying capacity becomes increasingly relevant to minimize environmental degradation.

Furthermore, the study's findings on dissatisfaction with basic facilities—such as toilets, seating, and parking lots—align with Sakti & Manvi (2023), who found through quantitative analysis that service quality strongly affects satisfaction and revisit intentions. In Aek Sijorni, similar complaints were voiced by respondents despite the area's high natural tourism potential.

Compared to national standards such as SNI 8379:2018, Aek Sijorni does not yet meet key criteria in terms of amenities, accessibility, and information. Moreover, when aligned with international standards by UNWTO (2022), there is no evident application of sustainable tourism principles such as waste management, environmental conservation, or active community involvement. The limited involvement of local residents highlights the importance of collaborative models like that proposed by Tarigan et al. (2023), which emphasize the community's role in locally-based tourism development.

In conclusion, the development of Aek Sijorni Natural Bath remains in its early stages and requires institutional strengthening, improved basic facilities, and technology-based innovations to enhance service quality and competitiveness. A development plan aligned with national standards and global sustainability principles is crucial. By adopting participatory development principles as outlined by Milanie (2023), Aek Sijorni's management can shift toward a more inclusive, locally-informed, and sustainable approach.

Implications of Findings

The findings indicate that natural beauty remains Aek Sijorni's main attraction. However, poor accessibility, inadequate facilities, and ineffective promotional efforts hinder the site's tourism development. The key implications are the need for infrastructure improvements, such as better walking paths and lighting. Additionally, essential facilities like toilets, restaurants, and recreational areas must be upgraded to meet visitor needs. A more integrated digital promotion strategy must also be implemented to expand the market reach. Equally important, involving local communities in site management can generate positive economic impacts and enhance local ownership of the destination.

5. Conclusions

Aek Sijorni Natural Bath holds significant potential to be developed as a leading nature-based tourist destination. However, the research findings indicate several challenges in terms of accessibility, supporting facilities, environmental cleanliness, and the effectiveness of promotional strategies. Poor road infrastructure, limited parking areas, and the lack of basic amenities have negatively impacted visitor satisfaction and reduced repeat visitation rates.

Therefore, it is recommended that site managers develop a measurable infrastructure improvement plan, including road widening, pedestrian path arrangement, and the installation of adequate lighting in public areas. The addition of specific facilities—such as local culinary zones, resting areas, and clean-standard toilets—should be prioritized while adjusting to the spatial layout of the area. Digital promotion efforts should be enhanced through the development of an official website, integration with online travel platforms, and the strategic use of social media targeting specific market segments.

Community empowerment should focus on hospitality training programs, community-based waste management, and the development of tourism products based on local wisdom. Local governments are also expected to establish incentive mechanisms and supportive regulations that encourage active community participation in site governance. Through the

implementation of data-driven policies and adaptive strategies, Aek Sijorni has the potential to evolve into a sustainable tourism destination that simultaneously provides direct economic benefits to local communities and preserves environmental integrity.

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