

EVALUATION OF TOURISM INFRASTRUCTURE IN SUPPORTING THE WATERFRONT CITY CONCEPT IN PARAPAT

Tony Sirait^{1*}, Abdi Sugiarto², Ruri Prihatini Lubis³

¹Mahasiswa Magister Perencanaan Wilayah dan Kota, Universitas Pembangunan Panca Budi, Medan, Sumatera Utara

^{2,3}Dosen Magister Perencanaan Wilayah dan Kota, Universitas Pembangunan Panca Budi, Medan, Sumatera Utara

E-mail: abdi_sugiarto@dosen.pancabudi.ac.id; tonysiraitbro@gmail.com

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Abstract

This study evaluates the readiness of tourism infrastructure in Parapat as a supporting area for the optimization of the Waterfront City concept in the Lake Toba region. Parapat plays a strategic role as the main gateway and tourism transit hub for visitors accessing waterfront development in Samosir Island. A mixed-methods approach was employed, emphasizing descriptive quantitative analysis supported by qualitative SWOT analysis. Primary data were collected through questionnaires distributed to tourists, field observations, and documentation of existing conditions, while secondary data were obtained from official publications and tourism planning documents. The evaluation focused on the availability of supporting facilities and the quality of area services as key indicators of infrastructure readiness. The results indicate that Parapat's tourism infrastructure is at a moderately adequate level, characterized by the presence of lakeside public spaces, pedestrian paths, and basic supporting facilities. However, several aspects, including area legibility, service consistency, public facility accessibility, and cleanliness management, still require improvement. The SWOT analysis reveals that Parapat has strong potential to function as an effective supporting area for the Waterfront City development, provided that service quality enhancement and integrated area management are strengthened. This study highlights the importance of supporting areas in ensuring sustainable and coherent tourism experiences within priority destinations.

Keywords: *infrastructure readiness; Parapat; supporting area; tourism infrastructure; waterfront city*

INTRODUCTION

Tourism development is a strategic sector in regional development due to its role in promoting economic growth, employment creation, and improvements in local community welfare. In the Lake Toba region, one of the current tourism development priorities is the Waterfront City in Pangururan, Samosir Regency, which is designed as a lake-based tourism activity center. The success of waterfront development is not solely determined by the quality of spatial arrangement in the core area, but also by the readiness of supporting-area infrastructure that facilitates tourist mobility and activities in a sustainable manner. Tourism infrastructure encompasses physical facilities, service systems, and area governance that are integrated to create safe, comfortable, and high-quality tourism experiences. Insufficient infrastructure readiness may reduce tourist satisfaction and hinder destination sustainability (Dalimunthe et al., 2020; Munir et al., 2025).

The waterfront city concept positions waterfront spaces as central elements of urban and tourism activities by integrating recreational, social, economic, and environmental functions. In practice, waterfront development extends beyond physical design of the core area and requires adequate supporting infrastructure and service quality to accommodate tourist needs from arrival to on-site activities. Without sufficient facilities and services, waterfront areas risk losing attractiveness and facing management challenges (Mahardika et al., 2022). Within the Lake Toba tourism system, Parapat plays a strategic role as the main gateway to Samosir Island and as a tourism transit hub for accessing the waterfront city area in Pangururan. This area serves as the initial entry point for both domestic and international tourists prior to crossing to Samosir Island. According to data from the Central Bureau of Statistics of Simalungun Regency, tourist visits to this region have shown a significant upward trend in recent years (BPS Kabupaten Simalungun, 2023). This condition places Parapat as an essential component within the supporting system of waterfront city development in the Lake Toba region.

However, increasing tourist flows toward the Pangururan waterfront city area are not always accompanied by proportional readiness of tourism infrastructure in supporting areas. Transit-oriented tourism areas frequently experience imbalances between visitor demand and available infrastructure capacity. Supporting facilities such as public toilets, pedestrian paths, parking areas, public spaces, and tourism information systems play a critical role in ensuring smooth and comfortable tourist movement. At the same time, tourism service quality covering friendliness, responsiveness, cleanliness, and information reliability shapes tourist perceptions and experiences prior to reaching the waterfront area. Disparities between facility availability and service quality may weaken tourism infrastructure readiness and reduce the supporting capacity of the area (Dalimunthe et al., 2020; Setiawati et al., 2024).

Previous studies have examined waterfront development and the role of facilities and services in tourism contexts. Mahardika et al. (2022) found that facilities and infrastructure significantly influence community activities in waterfront areas, while other studies emphasize that service quality and infrastructure readiness are crucial in building competitive tourism destinations (Munir et al., 2025; Setiawati et al., 2024). Nevertheless, most studies focus on coastal waterfronts or core destination areas, leaving limited attention to the evaluation of infrastructure readiness in supporting areas of lake-based waterfront cities.

Based on these conditions, this study examines the readiness of tourism infrastructure in Parapat as a supporting area for a lake-based waterfront city by focusing on the availability of supporting facilities and tourism service quality as key components. The research aims to describe existing infrastructure conditions in Parapat, assess the extent to which available facilities and services support tourism activities toward the Pangururan waterfront city area, and identify factors influencing area readiness through an integrated analytical approach. Academically, this study contributes to regional and urban planning discussions on the relationship between core and supporting areas in waterfront city development. Practically, the findings are expected to inform local governments and stakeholders in strengthening tourism infrastructure and service quality in Parapat to support more integrated and sustainable waterfront development.

LITERATURE REVIEW

Tourism infrastructure constitutes a fundamental component in supporting destination sustainability and competitiveness, encompassing not only physical facilities but also service systems, accessibility, and area governance that enable tourism activities to function effectively. Infrastructure readiness is closely associated with a destination's capacity to meet tourists' basic needs while providing safe, comfortable, and high-quality visitation experiences, and plays a significant role in determining destination success, particularly within the context of sustainable tourism development (Dalimunthe et al., 2020). The level of infrastructure readiness can be assessed through the availability and condition of public facilities such as public toilets, parking areas, pedestrian paths, public open spaces, and tourism information systems, where adequate provision enhances visitor comfort and length of stay, while inadequacy may reduce destination image and constrain tourism potential, especially in destinations experiencing rapid visitor growth.

Within tourism area development, the waterfront city concept has evolved as a planning approach that positions waterfront spaces as integral elements of urban and tourism activities by integrating recreational, social, economic, and environmental functions. Waterfront areas therefore function not only as aesthetic components but also as active public spaces that support social interaction and economic activity. Empirical studies show that waterfront development influences community activities and public space utilization; however, physical development without adequate supporting facilities and service systems may lead to visitor discomfort, environmental degradation, and management challenges (Mahardika et al., 2022). Consequently, the waterfront city concept should be understood as an integrated development system that requires comprehensive tourism infrastructure readiness rather than merely physical spatial arrangement.

Beyond physical facilities, tourism service quality represents a critical non-physical dimension of infrastructure readiness, reflecting how facilities and systems are managed, operated, and perceived by tourists. The SERVQUAL model introduced by Parasuraman et al. (1988), which includes tangibles, reliability, responsiveness, assurance, and empathy, remains widely applied in tourism research to assess service performance. Previous studies demonstrate that service quality is closely linked to tourist satisfaction, destination image, and revisit intention, where both physical environment and service performance significantly influence visitor perceptions (Pratama, 2025; Pinaria et al., 2025). Accordingly, service quality functions as a bridge between facility availability and tourist experience and cannot be separated from discussions of tourism infrastructure readiness.

The relationship between supporting facility availability and tourism service quality is therefore synergistic in shaping tourism infrastructure readiness. Adequate physical facilities provide the foundation for effective service delivery, while high service quality strengthens tourists' perceptions of facility functionality and value. Research on waterfront public spaces indicates that limitations in basic facilities can reduce comfort levels and hinder optimal space utilization (Suminar & Endriyanto, 2024). In tourism contexts, infrastructure readiness emerges from the interaction between physical and non-physical components, where infrastructure and institutional quality directly influence tourist satisfaction and destination sustainability (Munir et al., 2025). Hence, the evaluation of tourism infrastructure readiness should be conducted through an integrated approach that simultaneously considers facility availability and service quality.

Conceptual Framework

Tourism infrastructure readiness in waterfront-based tourism areas is not formed independently but results from the interaction of multiple supporting components. In this study, the availability of supporting facilities and the quality of tourism services are considered the two main aspects directly experienced by tourists and influencing overall area functionality. Therefore, an integrated approach is required to evaluate tourism infrastructure readiness in supporting areas.

To illustrate the relationships among the examined variables and the position of this study within waterfront-based tourism development, a conceptual framework is formulated. This framework serves as an analytical guide for assessing the interaction between supporting facilities, service quality, and tourism infrastructure readiness. The conceptual framework is presented in Figure 1.

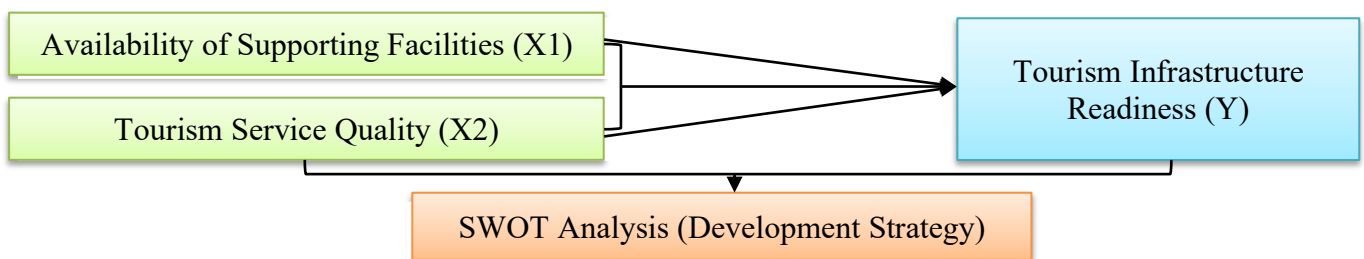


Figure 1. Conceptual Framework of the Research

Source: Author's elaboration, 2025.

Based on Figure 1, tourism infrastructure readiness is influenced by two main variables: supporting facility availability and tourism service quality. Supporting facilities include physical elements that enable tourism activities, such as public toilets, parking areas, pedestrian paths, public spaces, signage, transportation facilities, and accessibility for persons with disabilities. These facilities form the basic foundation for the functional performance of the tourism area. Tourism service quality represents the non-physical dimension of infrastructure readiness and reflects how facilities are managed and experienced by tourists. Service aspects such as friendliness, responsiveness, cleanliness, and information reliability strengthen or weaken the effectiveness of available facilities. The interaction between supporting facility availability and tourism service quality ultimately determines the level of tourism infrastructure readiness in Parapat as a supporting area for the Waterfront City concept.

METHOD

This study employed a mixed-methods approach, emphasizing descriptive quantitative analysis complemented by qualitative SWOT analysis to obtain a comprehensive understanding of tourism infrastructure readiness through the integration of tourist perception assessment and strategic evaluation of internal and external area conditions. The research was conducted in Parapat, Simalungun Regency, North Sumatra Province, focusing on major tourism activity and transit areas, including Pantai Bebas Parapat, Tiga Raja Port, and the Sisingamangaraja corridor, from January to July 2025. The study utilized both primary and secondary data. Primary data were collected through structured questionnaire surveys administered to tourists, supported by field observations and limited interviews with local stakeholders, while secondary data were obtained from official statistics, planning documents, and tourism-related publications to contextualize the empirical findings. The study population comprised tourists visiting Parapat and local stakeholders involved in tourism activities, with survey respondents selected using

purposive sampling based on criteria of being at least 17 years old, having used public facilities in the study area, and consenting to participate. A total of 100 respondents was considered adequate for descriptive tourism analysis. The research variables included supporting facility availability, tourism service quality, and tourism infrastructure readiness. Supporting facility availability was assessed based on the condition and availability of public toilets, parking areas, pedestrian paths, public spaces, signage, transportation facilities, and accessibility for persons with disabilities, while tourism service quality was measured through perceptions of friendliness, responsiveness, cleanliness, information reliability, and overall service performance. Tourism infrastructure readiness was evaluated as an integrated outcome of facility availability and service quality. Data were collected using a structured questionnaire employing a five-point Likert scale. The instrument was tested for validity and reliability prior to analysis. Quantitative data were analyzed descriptively using frequencies, percentages, and mean scores, and the results were subsequently synthesized with SWOT analysis to identify strengths, weaknesses, opportunities, and threats influencing tourism infrastructure readiness in Parapat and to formulate strategic development directions. All research procedures were conducted in accordance with ethical principles, including informed consent, confidentiality, and the use of data exclusively for academic purposes.

RESULTS AND DISCUSSION

Existing Conditions of the Parapat Tourism Area

Parapat's tourism area is equipped with pedestrian infrastructure and lakeside public spaces that support tourist mobility and recreational activities. Pedestrian facilities include walkways, sidewalks, and bicycle lanes along several lakeside segments, indicating efforts to accommodate non-motorized tourist movement. In addition, the area provides various lakeside public spaces, such as waterfront-oriented cafés, port waiting areas facing Lake Toba, and open spaces used for leisure and recreation. These conditions are illustrated in Figure 2.

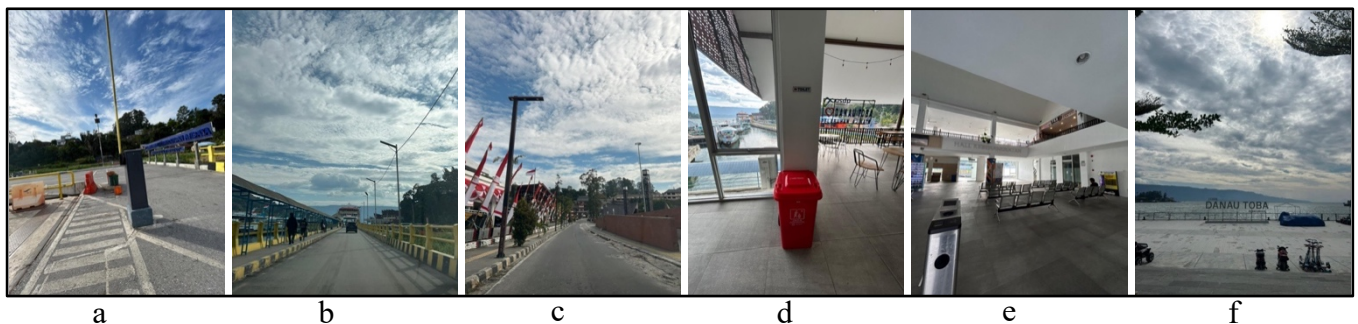


Figure 2. Pedestrian Infrastructure and Lakeside Public Spaces in the Parapat Tourism Area

(a) pedestrian walkway along the lakeside corridor, (b) sidewalk within the tourism area, (c) bicycle lane in public space, (d) waterfront-oriented café, (e) port waiting area facing Lake Toba, (f) playground and open space with a Lake Toba backdrop.

Source: Author's documentation, 2025.

Figure 2. shows that both pedestrian facilities and lakeside public spaces are generally available and actively utilized by tourists, contributing to mobility, social interaction, and visual appreciation of the Lake Toba landscape. However, variations in continuity, spatial integration, design quality, and comfort remain evident across locations, particularly in areas intersecting with vehicular traffic and port activities. This indicates that although basic infrastructure and public spaces have been established, further improvements in design consistency, integration, and area management are required to enhance safety, comfort, and the overall tourism experience. Following the availability of pedestrian infrastructure and lakeside public spaces, the tourism area of Parapat is also supported by signage and tourism information systems that assist visitors in spatial orientation. Tourism signage and information boards are available at several activity nodes and function to provide direction, facility identification, and service-related information within the area. The condition of tourism signage and information systems is presented in Figure 3.

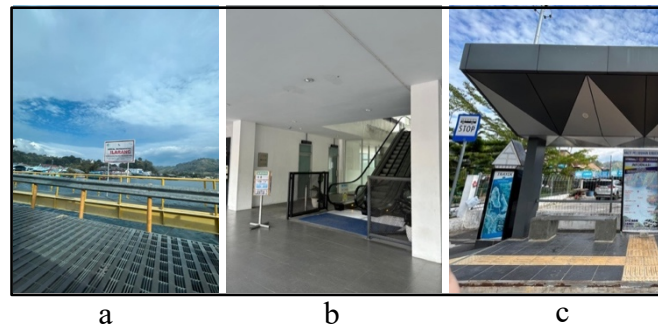


Figure 3. Tourism Signage and Information in the Parapat Area

(a) area information board, (b) directional and facility signage, (c) safety and service information signage.

Source: Author's documentation, 2025.

Figure 3. shows that signage generally functions as an information medium within the tourism area. However, variations in readability, placement, and visual consistency among signage elements remain evident. These conditions may affect the ease of visitor orientation, particularly for first-time tourists, indicating the need for more standardized design and integrated information systems. In addition to mobility and public spaces, Parapat's tourism area is supported by basic tourism facilities and area management services that fulfill visitors' essential needs. These facilities include public sanitation and parking areas, which support tourist activities and movement within the area, as well as cleanliness conditions and service operations in key activity zones. The condition of basic facilities and area services is illustrated in Figure 4.

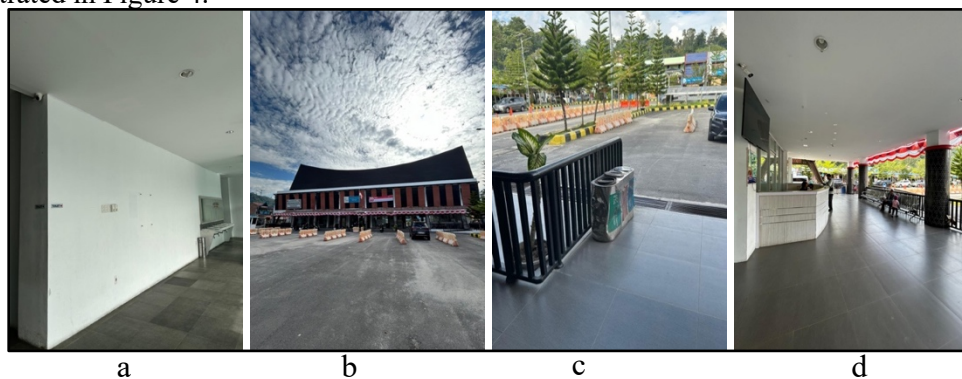


Figure 4. Basic Tourism Facilities and Area Services in the Parapat Tourism Area

(a) public toilets in the tourism area, (b) tourism parking area with sufficient capacity, (c) cleanliness condition of the port area, (d) tourism service activities within a well-maintained environment.

Source: Author's documentation, 2025.

Figure 4. shows that basic tourism facilities and area services are generally available and function to support tourism activities. However, their effectiveness is strongly influenced by maintenance quality, cleanliness, and consistent management practices. Variations in facility condition and service performance across locations indicate the need for improved integration and sustainable area management to maintain service quality and support Parapat's role as a supporting area for waterfront city development.

Instrument Validity and Reliability Test Results

Prior to analysis, the research instrument was tested for validity and reliability. Validity testing using the Pearson Product Moment method (p -value < 0.05) shows that all indicators for supporting facility availability (X1) and tourism service quality (X2) meet the significance criteria. The validity test results are summarized in Table 1.

Table 1. Instrument Validity Test Results

Variable	Indicator	r-value	Status
Supporting Facility Availability (X1)	Public toilets	0.480	Valid
	Parking area	0.670	Valid
	Pedestrian paths	0.635	Valid
	Public spaces	0.777	Valid
	Signage	0.714	Valid
	Transportation facilities	0.688	Valid
	Accessibility for persons with disabilities	0.395	Valid
Tourism Service Quality (X2)	Friendliness	0.813	Valid
	Responsiveness	0.700	Valid
	Cleanliness	0.568	Valid
	Information reliability	0.781	Valid
	Service quality	0.605	Valid

Source: Processed research data, 2025.

All indicators demonstrate moderate to strong correlations, indicating that the instrument adequately represents the measured constructs.

Reliability testing using Cronbach’s Alpha confirms good internal consistency for both variables, as shown in Table 2.

Table 2. Instrument Reliability Test Results

Variable	Cronbach’s Alpha	Interpretation
Supporting Facility Availability (X1)	0.743	Good reliability
Tourism Service Quality (X2)	0.725	Good reliability

Source: Processed research data, 2025.

Based on Table 2, the Cronbach’s Alpha values for both variables exceed the minimum threshold of 0.70, indicating good internal consistency; therefore, the questionnaire instrument is considered reliable and suitable for further analysis of tourism infrastructure and service conditions in Parapat.

Assessment of Tourism Infrastructure and Services in Parapat

Tourists’ perceptions of supporting facility availability are summarized in Table 3.

Table 3. Average Scores of Tourism Infrastructure and Service Assessment in Parapat

Variable	Indicator	Mean Score	Category
Supporting Facility Availability (X1)	Public toilets availability	2.75	Adequate
	Parking area availability	3.05	Adequate
	Pedestrian path availability	2.79	Adequate
	Lakeside public space availability	3.35	Good
	Tourism signage availability	3.30	Good
	Supporting transportation facilities	3.21	Good
	Accessibility for persons with disabilities	3.07	Adequate
Tourism Service Quality (X2)	Friendliness	3.44	Good
	Responsiveness	3.76	Good
	Cleanliness	2.93	Adequate
	Tourism information reliability	3.42	Good
	General service performance	2.78	Adequate

Source: Processed research data, 2025.

Based on Table 3, the assessment of supporting facility availability (X1) indicates that lakeside public spaces, tourism signage, and supporting transportation facilities receive the highest mean scores and are categorized as good, reflecting relatively adequate provision of facilities directly related to tourism activities and visitor mobility. In contrast, public toilets, pedestrian paths, and accessibility for persons with disabilities are categorized as adequate, indicating limitations in physical quality, comfort, and facility integration. Regarding tourism service quality (X2), responsiveness and friendliness achieve the highest scores and are categorized as good, suggesting generally positive basic service interactions in the Parapat tourism area. However, cleanliness and general service performance remain at an adequate level, highlighting the need for improved service consistency and area management, particularly in

high-intensity tourism zones. Overall, the combined assessment of X1 and X2 shows that tourism infrastructure and services in Parapat are moderately adequate. Variations across indicators reflect uneven performance among facility and service components, providing an empirical basis for evaluating tourism infrastructure readiness in supporting the optimization of the waterfront city concept.

Tourism Infrastructure Readiness in Supporting the Waterfront City

The readiness of Parapat’s tourism infrastructure in supporting the optimization of the waterfront city concept was assessed through a synthesis of supporting facility availability (X1) and tourism service quality (X2). This synthesis aims to evaluate the extent to which infrastructure and services in Parapat function as a supporting system for tourist mobility, comfort, and experience before and after accessing the waterfront city area across Lake Toba. In the context of Lake Toba’s designation as a national priority tourism destination, the readiness of supporting areas such as Parapat is strategically important for maintaining continuity of tourist experience. Regional tourism data show that Simalungun Regency recorded 1,074,886 tourist visits in 2023, indicating high tourist movement intensity and confirming Parapat’s role as a key transit node and lakeside public space within the Lake Toba tourism system. The synthesis of supporting facility availability (X1) and infrastructure readiness (Y) indicates that the presence of physical facilities in Parapat provides a foundational level of readiness as a tourism gateway. Respondent assessments show that lakeside public spaces, parking areas, tourism signage, and supporting transportation facilities are generally rated as good, enabling tourists to conduct transit activities, short-term recreation, and spatial orientation before continuing their journey to the waterfront city area. However, pedestrian paths and accessibility for persons with disabilities remain in the adequate category, indicating uneven physical readiness and the need for improved quality and integration.

Furthermore, the synthesis of tourism service quality (X2) and infrastructure readiness (Y) highlights the importance of non-physical aspects in shaping overall readiness. Responsiveness and friendliness are rated as good, contributing positively to visitor comfort, particularly in port areas and main public spaces. In contrast, cleanliness and general service performance remain at an adequate level, suggesting that greater consistency in service delivery and area management is required to support sustainable and high-quality tourism experiences. Overall, the combined synthesis of supporting facility availability (X1) and tourism service quality (X2) indicates that Parapat has reached an initial and moderately adequate level of tourism infrastructure readiness as a supporting area for the waterfront city. While basic infrastructure and responsive services enable Parapat to function effectively as a transit node and lakeside public space, variations across indicators show that readiness remains partial and not yet optimal. Strengthening system integration, improving the quality of specific facilities, and ensuring consistent service management are therefore essential to enhance Parapat’s role in supporting sustainable waterfront city development. This synthesis provides the empirical basis for the subsequent SWOT analysis.

SWOT Analysis Results of Parapat Tourism Infrastructure

The SWOT analysis was conducted descriptively to identify strategic internal and external factors influencing tourism infrastructure readiness in Parapat. The SWOT matrix is presented in Table 4.

Table 4. SWOT Matrix of Tourism Infrastructure Readiness in Parapat

Internal / External	Opportunities	Threats
Strengths	Utilize lakeside public spaces, pedestrian paths, and Lake Toba’s panorama to strengthen Parapat’s role as a tourism transit area and gateway. Optimize basic tourism facilities and area connectivity.	Maintain infrastructure quality and environmental cleanliness to enhance competitiveness and anticipate destination competition.
Weaknesses	Improve signage quality, information systems, and public facility accessibility in line with increasing tourist flows.	Strengthen area management coordination to reduce service inconsistency and infrastructure pressure through sustainable planning.

Source: Author’s analysis, 2025.

The SWOT results indicate that Parapat’s strengths and strategic position provide opportunities to support waterfront city development, while internal weaknesses related to facility quality and service consistency require attention to mitigate external threats.

Discussion

The findings demonstrate a clear relationship between supporting facility availability (X1), tourism service quality (X2), and tourism infrastructure readiness (Y) in Parapat as a supporting area for waterfront city development. The relatively higher performance of lakeside public spaces, pedestrian environments, and information systems compared to sanitation and accessibility reflects patterns identified in waterfront public space studies, which emphasize spatial experience quality, orientation, and accessibility as key determinants of user perception (Chen et al., 2022; Silva & Rodrigues, 2023; Gospodini, 2022; Wang et al., 2024). From a service perspective, responsiveness and friendliness support tourist comfort, while inconsistent cleanliness and general services highlight governance challenges commonly found in transit-oriented tourism areas (Nguyen et al., 2023; Al-Hussein et al., 2024). This condition suggests that physical infrastructure alone is insufficient without consistent service management.

The novelty of this study lies in positioning Parapat as a supporting node rather than a core waterfront destination. This perspective aligns with studies on port–city integration and passenger terminal systems, which emphasize connectivity, information clarity, and supporting services as critical elements of seamless tourism experiences (Kourtit et al., 2022; Pallis et al., 2023). The descriptive SWOT analysis reinforces these findings by mapping internal and external conditions as a basis for strategic direction, consistent with tourism development studies employing similar approaches (Rahmawati et al., 2022; Siregar et al., 2024). Planning literature further emphasizes that infrastructure strengthening must be accompanied by cross-stakeholder coordination and data-based management to ensure sustainable area performance (Sugiarto, 2022; Sugiarto, 2023; Sugiarto & Timothy, 2024; Lubis, 2022; Lubis, 2023; Lubis & Hutagalung, 2024; Nuraini, 2022; Nuraini & Siregar, 2024).

Studies focusing on climate resilience and nature-based waterfront regeneration, as well as bibliometric tourism analyses, are not directly comparable to this perception-based, site-specific evaluation (Kabisch et al., 2022; O'Donnell et al., 2023; Zhang et al., 2024; Pereira et al., 2025), clarifying the scope and contribution of this research. Overall, strengthening Parapat's role as a supporting area for waterfront city development requires improvements in lakeside public space quality, consistent area legibility through integrated information systems, and more reliable basic service delivery. When facility availability and service quality are enhanced in an integrated manner, Parapat's tourism infrastructure readiness will be better positioned to support sustainable waterfront city development.

CONCLUSION

This study confirms that Parapat plays a strategic role as a supporting area for the optimization of the waterfront city concept in the Lake Toba region, particularly as a tourism transit node, lakeside public space, and gateway to Samosir Island. The evaluation of supporting facility availability and tourism service quality indicates that Parapat's tourism infrastructure readiness is at a moderately adequate level. Lakeside public spaces, tourism signage, and supporting transportation facilities are perceived positively, while sanitation facilities, pedestrian continuity, accessibility for persons with disabilities, cleanliness, and general service performance remain uneven, reflecting partial integration and inconsistent management. These findings indicate that Parapat has established a basic foundation to support waterfront city development, yet its performance has not reached an optimal level.

To strengthen Parapat's role as a supporting area, improvements should focus on enhancing the integration and continuity of pedestrian infrastructure, increasing accessibility for all users, standardizing tourism information systems to improve area legibility, and ensuring consistent maintenance and cleanliness of basic facilities. Strengthening coordination among stakeholders and improving service consistency are also essential to sustain visitor comfort and experience. By prioritizing integrated infrastructure development and area management rather than solely expanding physical facilities, Parapat can more effectively support the continuity of tourist movement and experience within the broader waterfront city system of the Lake Toba region.

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