Leveraging Social Media Data for Sustainable Tourism Development: Spatial Analysis of Tourist Destinations

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Abstract

The COVID-19 pandemic significantly disrupted the tourism industry by restricting social activities and raising concerns about overcrowding at popular destinations. To address these challenges, effective strategies are needed to manage visitor distribution. This study analyzes social media data from a travel platform, including reviews and ratings, to assess the distribution and popularity of tourist destinations in West Java. The research explores the potential of social media as a resource for local tourism planning and development, aiming to enhance West Java's rich offerings in arts, culture, culinary experiences, and adventure tourism. Findings reveal visitor patterns, with a concentration of tourists in urban areas compared to districts, and highlight the popularity of natural attractions in Bogor, Sukabumi, Bandung, Garut, and Pangandaran. Additionally, Cirebon emerges as a key hub for cultural tourism and transit. By leveraging reviews and spatial data, this study underscores the role of social media in supporting sustainable tourism strategies. Tools like ArcGIS are recommended to visualize tourist patterns, promote ecotourism, and achieve West Java's green tourism goals in the post-pandemic era.

Keywords: GIS; New Normal; Social media; Spatial analysis; Tourism

INTRODUCTION

Tourism is one of the fastest-growing industries in Indonesia and represents the country's most significant economic sector and source of foreign exchange earnings (Mariyono, 2017; Sipahutar, 2019). It contributes substantially to foreign exchange and employment generation, positioning it as a critical pillar of Indonesia's economy. However, the COVID-19 pandemic disrupted this trajectory, severely impacting tourism. According to the Indonesian Central Statistics Agency, international tourist arrivals to Indonesia in 2021 dropped by 81.78% compared to 2020, resulting in a loss of IDR 200.92 trillion in economic potential and a 53.2% decline in tourism's contribution to GDP (Purba et al., 2021). The pandemic also affected related sectors, such as restaurants and hotels, which experienced significant revenue losses due to reduced tourist activity (Soehardi & Untari, 2020). These developments underscore the urgent need for strategies to rebuild Indonesia's tourism sector.

The pandemic imposed restrictions on social activities to prevent crowding, a challenge intrinsically linked to tourism activities. Indonesia implemented strict travel restrictions, suspending flights and banning entry from red-zone countries, further affecting tourism operations (Purba et al., 2021). These measures disrupted the industry, forcing hotels to reduce occupancy, curtailing employment opportunities, and compelling workers to transition to other industries (Soehardi & Untari, 2020). In response, the government launched initiatives to mitigate these impacts, including social assistance programs for tourism workers and discounts for domestic travel destinations (Kristiana et al., 2021). Scholars have also highlighted the need for innovative strategies, such as leveraging data-driven tools to provide destination insights and better manage visitor distribution (Purba et al., 2021).

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Strategic approaches that combine planning, technology, and infrastructure development are essential to adapt to these challenges. (Utami & Kafabih, 2021) proposed six initiatives for recovery, including preparing tourist destinations, enhancing connectivity, implementing Cleanliness, Health, Safety, and Environmental Sustainability (CHSE) protocols, and promoting the creative economy through digitalization. Such strategies aim to rebuild Indonesia's tourism industry while aligning with global sustainability trends. Tourism strategies during the pandemic require robust data and insights to manage visitor flows and design interventions effectively. Geographic and spatial data about tourist locations are valuable for understanding visitor patterns and supporting decision-making (Movahed & Gahlehteimouri, 2019). Social media platforms offer unique opportunities to gather and analyze data on tourist preferences and behaviors. With over 61.8% of Indonesians using social media (We Are Social Digital, 2021), user-generated content such as reviews and ratings has become a rich source of information for tourism development (Brynjolfsson & Collis, 2019; Sotiriadis, 2017). These data provide insights into consumer preferences, helping to design more effective tourism strategies.

This study focuses on West Java, a region known for its diverse tourism potential, including arts, culture, culinary experiences, and adventure tourism (Warsudi, 2018). By analyzing reviews and ratings from a popular social media travel platform, the research aims to explore two key areas: 1) the distribution of West Java tourist destinations based on user reviews and 2) the patterns of popular attractions in the region. It also examines whether social media platforms can serve as effective sources for local tourism planning and development. By addressing these objectives, the study seeks to provide actionable insights to support sustainable tourism strategies and boost Indonesia's tourism recovery, particularly in West Java.

LITERATURE REVIEW

Social media plays an important role in tourism, especially in information-seeking, decision-making behavior, and tourism promotion (Hysa et al., 2021). Indonesia has one of the highest numbers of internet users in the world (Nurhayati, 2021). This is the consequence of the government's, corporate sector's, and individuals' constant promotion of tourism in Indonesia, which has succeeded in luring tourists to visit the country. As a means of disseminating information, the Internet has altered how people communicate. Many travelers utilize social media to share their travel experiences in Indonesia, such as blogs, Facebook, Instagram, Twitter, and the various social media platforms for tourism. Social media is a digital/internet medium that can potentially empower the community. Players in the tourism industry utilize social media as a marketing tool. Social media has, to a lesser extent, altered the tourism consumption trend. Tourism has become a secondary requirement for society, and using social media to promote tourism is a new strategy to encourage tourist mobility (Trihayuningtyas et al., 2019). In addition to social media marketing, it can also provide information about the movement of tourists (Utami & Kafabih, 2021; Vu et al., 2018); social media with urban planning (Lin & Geertman, 2019; Nummi, 2019); social media with tourist behavior (İştin, 2020; Xue & Zhang, 2020); social media with tourism planning (Zarezadeh et al., 2018; Zeng & Gerritsen, 2014) and social media with local tourists (Alonso-Almeida et al., 2019; Ghermandi et al., 2020).

Social media is a social network, an online community of people with the same interests and activities. This community offers users a variety of information and opportunities for interaction through chats, videos, email exchanges, and participation in blogs and discussion groups. This network also includes categories of relationships between people and can have a friendship recommendation system, an activity recommendation system, or an object recommendation system. Social media is also defined as a site for individuals to connect with known friends offline and online or with known friends only. Social media provides opportunities for interaction, including application plug-ins, groups, or fan pages. TripAdvisor is an example of a social media travel platform. Stephen Kaufer and Langley Steinert started TripAdvisor, a large travel social media platform, in 2000 in Neddham, Massachusetts, United States of America, intending to guide and advise visitors planning their journeys. Travelers can benefit from reviews and comments from previous travelers (Chong et al., 2018). Prospective tourists will prepare for the trip more maturely and get recommendations on the trip's activities. Every month, TripAdvisor assists travelers in making their trips the best they can be. Travelers worldwide utilize their website and app to peruse over 859 million reviews and comments on over 8.6 million hotels, restaurants, experiences, airlines, and cruises. Travelers, whether planning or on a trip, use social media travel platforms to compare the lowest costs for hotels, airlines, and cruises, book tours and famous sights, and reserve tables at dance restaurants (IN Press Center | About TripAdvisor, 2019)

Customer Feedback and Rating: Customers, consumers, or followers create images, videos, reviews, and other types of content known as User-Generated Content (UGC) .. Social media activities of internet users can generate UGC, enabling the identification of consumer needs, product perceptions, preferences, and internet user needs (Schmunk et al., 2013). Many Indonesians use social media to share their experiences, share

information, express opinions, exchange ideas, and create other content. These users generate a rapidly increasing amount of content every day. Several features are available on the social media travel website, including the review and rating option. Reviews are social media posts that include user comments. Typically, users leave these remarks to solicit feedback (Luo et al., 2020). Monitoring user comments on social media is crucial for accurately conveying the company's message to consumers (Andzulis et al., 2012), and the rating feature serves to gauge the user's perception of the experience and their satisfaction with the services at tourist destinations. The rating feature has a range of values (Febriani & Dewi, 2019).

GIS and Tourism: Geographic information systems (GIS) are a fundamental tool in the tourism planning process, both on the demand and supply sides, with a particular emphasis on resource inventory and strengthening environmental resource protection. In addition, monitoring tourism activities also enables the detection of conflicting demands and provides information to consumers about tourist destinations on the Internet using a map-based application (Jovanovic & Njegus, 2008). We can consider using GIS in the tourism sector as a tool that offers widely applicable techniques and technologies for long-term tourism development. It is used to develop modern tourism applications through the use of maps. GIS integrates tourism information and constructs the tourism map, which includes elements such as object symbols for item types, object names, hotel classifications (stars), and connections to homepage objects for additional navigation.

(Jovanovic & Njegus, 2008) used GIS on Zlatibor and Zlatar destinations to inventory zoning areas, land uses, and protected areas. He also used it for analytical purposes to determine the number and density of hotels, vacation homes, clubs, and sports facilities like swimming pools, playgrounds, football fields, and tennis courts. Finally, he used it for management and manufacturing purposes, such as evaluating land use plans based on demographics and natural features and planning investments in the tourism sector. (Firliana et al., 2016) used GIS to improve information on tourist attractions located in Tulungagung Regency, Indonesia. The results were valuable for Indonesians and those from other countries who wanted to learn more about tourist sites in Tulungagung Regency. (Albuquerque et al., 2018) used web-based GIS to support decision-making processes and tourists planning to visit the destination; an integrated geodatabase to define and georeference tourist routes, such as the Architecture and Fishing Routes; and to build new routes by integrating different types of products and resources (multi-attraction or multi-typology routes). Another benefit is the availability of a tool that makes it easier to advertise the tourism destination (Muriuki & Kenduiywo, 2021) and support worship information for halal tourism (Afnarius et al., 2020).

METHODS

This study aims to demonstrate the potential of social media travel platforms in gathering information about tourists' preferences at specific destinations. This is a crucial step in data collection for local tourism development planning. One popular social media travel platform provides a wealth of information, including ratings and reviews (comments) visitors leave at various tourist destinations. Tourists rate their travel experiences, and the more reviews and ratings a destination receives, the more insights it offers about visitor interest.
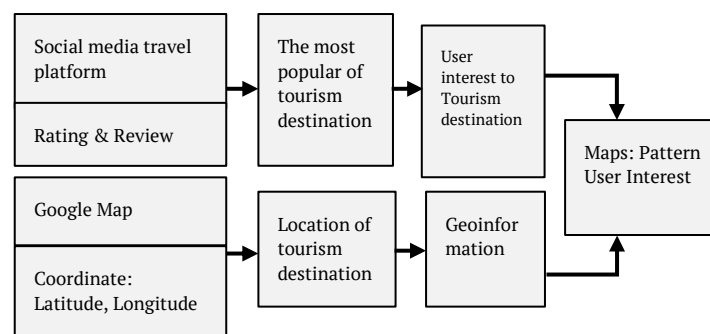

Figure 1. Research Flow

In 2021, we collected data using a web crawling technique with PHP Hypertext Preprocessor, an embedded scripting language in HTML and saved it in CSV format. We extracted data from One of the popular social media travel platforms, focusing on West Java's tourist attractions and targeted fields, including [id, location, category, description, rating, and review]. We sorted each destination based on the highest number of reviews and ratings and then used Google Maps to obtain their coordinates. We then processed the coordinate data using ArcGIS geoinformation software to visualize the distribution of locations and assess potential crowd

concentrations based on the number of reviews. This study specifically focused on tourist destinations within the attraction category in West Java. We selected the top 50 destinations with the most reviews and ratings and used Google Maps to gather their coordinates. We processed the data in GIS software (ArcGIS) to analyze the distribution of locations and identify potential crowd hotspots. We expect the visualization to highlight clusters of popular and high-demand tourist destinations, helping to answer the research questions (Figure. 1).

RESULT

The results of data crawling in the West Java attraction category collected 5,963 tourist locations from 6 cities. Data fields include [id, location, category, description, rating, review, crawl_time, longitude, and latitude]. Following the research limitations that have been made, 5,963 locations are sorted based on the number of reviews; each city is only taken 50 locations per sub-category with shorting descending. This ensures that each city has 150 locations, with each sub-category containing 50 locations. The study covers a total of 450 tourist locations. We categorize attraction into three: "do" (places to see/attractions), "stay" (hotels), and "eat" (restaurants—dine, drink, and feast).

Table 1. Example of data

id	location	category	name	description	rating	review	crawl_time	Longitude	Latitude
1722	Bandung	Restaurant	Hummingbird Eatery	European, Indonesian	4.5	3450	4:18:07 PM	107.618256	-6.90484139
1727	Bandung	Restaurant	Miss Bee Providore	Italian, American	4.5	2179	4:18:07 PM	107.6090767	-6.868251789
1738	Bandung	Restaurant	Kampung Daun	Asian, Indonesian	4	1806	4:18:07 PM	107.58972	-6.817393373
1724	Bandung	Restaurant	The Restaurant	European, Asian	5	1544	4:18:07 PM	107.6088219	-6.863124362
1731	Bandung	Restaurant	Atmosphere Resort Cafe	American, Cafe	4.5	941	4:18:07 PM	107.6133379	-6.926443832
1745	Bandung	Restaurant	The Valley	International, European	4	754	4:18:07 PM	107.6340885	-6.863434668

The researcher gathered data to determine where most reviews from the six cities were located, as depicted in Table.2

Table 2. Most Reviews

No	City	Do	Stay	Eat
1	Bandung	Trans Studio Mall Category: Attraction Review: 2.179 Rating:4	Padma Hotel Bandung Category: Hotel Review: 3.792 Rating: 5	Hummingbird Eatery Category: Restaurant Review: 3.450 Rating: 4.5
2	Bogor	Bogor Botanical Gardens Category: Attraction Review: 1.614 Rating:4	Novotel Bogor Golf Resort and Convention Center Category: Hotel Review: 2.480 Rating: 4.5	Cimory Riverside - Mega Mendung Category: Restaurant Review: 941 Rating: 4
3	Cirebon	Keraton Kasepuhan Category: Attraction Review: 339 Rating:3.5	Aston Cirebon Hotel & Convention Center Category: Hotel Review: 1.105 Rating: 4.	Nasi Jamblang Mang Dull Category: Restaurant Review: 535 Rating: 4
4	Garut	Mount Papandayan Category: Attraction Review: 215 Rating:4.5	Favehotel Cimanuk Garut Category: Hotel Review: 371 Rating: 4.	Nasi Liwet Pak Asep Strawberry 3 Category: Restaurant Review: 173 Rating: 4
5	Pangandaran	Pangandaran Beach Category: Attraction Review: 253 Rating:4	Pondok Wulan Category: Hotel Review: 204 Rating: 4.5	Bamboo Beach Bar Pangandaran Category: Restaurant Review: 125 Rating: 4
6	Sukabumi	Ujung Genteng Beach Category: Attraction Review: 191 Rating:4	Anugrah Hotel Category: Hotel Review: 364 Rating: 4	Bubur Ayam Bunut Siliwangi Category: Restaurant Review: 112 Rating: 3.5

Source: Tripadvisor data (2021)

The research will focus on 450 tourist destinations in total. We then use Google Maps apps to search for each location's ordinate point (latitude and longitude). We visualized the coordinate data in this study using ArcGIS, which allowed us to adjust the coordinates to the map of West Java. ArcGIS classifies each coordinate

based on the Universal Transverse Mercator (UTM), dividing Indonesia into nine north and nine south zones. Indonesia's UTM zone number ranges from 46 to 54 (Bumi, 2018; Pembagian Zona UTM Indonesia Berdasarkan Titik Koordinatnya, 2022). The UTM data is then integrated with Indonesian data.

Table 3. Adjusted Ordinate Point Tourist Destination Into Zone

Decimal Degrees		UTM				Degrees, minutes and seconds		UTM waypoint Garmin
Latitude	Longitude	East (X)	North (Y)	Zone	Band	Latitude	Longitude	
-6.9246848	107.6361049	791307.400	9233768.588	48	M	6° 55' 28.8	-107° -38' -9.978" W	48 M 791307 9233769
-6.9151682	107.6089722	788312.799	9234838.248	48	M	6° 54' 54.6	-107° -36' -32.3" W	48 M 788313 9234838
-6.88907835	107.596087	786903.651	9237733.073	48	M	6° 53' 20.6	-107° -35' -45.913" W	48 M 786904 9237733
-6.8829227	107.5995559	787290.981	9238412.153	48	M	6° 52' 58.5	-107° -35' -58.401" W	48 M 787291 9238412
-6.89826945	107.6552971	793446.059	9236679.946	48	M	6° 53' 53.7	-107° -39' -19.069" W	48 M 793446 9236680
-6.90034545	107.6209584	789647.303	9236471.234	48	M	6° 54' 1.24	-107° -37' -15.45" W	48 M 789647 9236471
-6.7899841	107.5786457	785033.683	9248708.840	48	M	6° 47' 23.9	-107° -34' -43.125" W	48 M 785034 9248709
-6.9126657	107.6027467	787625.882	9235118.941	48	M	6° 54' 45.5	-107° -36' -9.888" W	48 M 787626 9235119

Base Map used ArcGIS Software to determine the distribution of West Java tourism location points based on West Java attractions with the code of doing (blue-round), staying (red-triangle), and eating (green square). Figure 2 and Figure 3 visualize the result:
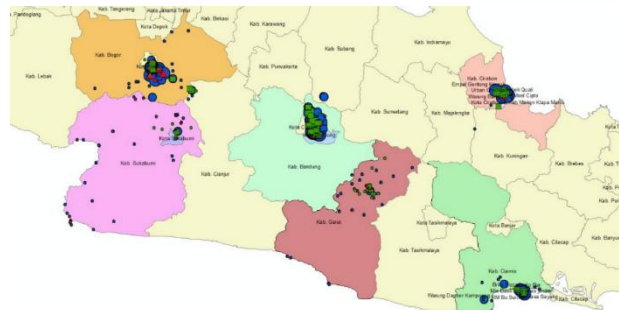

Figure 2. Distribution Of Tourist Destinations In Six West Java Cities Based On Tripadvisor User Reviews Discussion

This study aims to determine the distribution of tourist destinations in six cities of West Java based on the most attractive destinations on one of the social media travel platforms, and data successfully demonstrates the tourism pattern (Figure 2). The location with the most reviews in Bogor City is Bogor Botanical Gardens. It has 1,614 reviews, and the tourism magnet in Bogor is concentrated in the urban area, especially for the distribution of sub-categories ("Do," "Eat," "Stay"). Based on Figure 3, the three sub-categories are fairly evenly spread across Bogor City and the Regency of Bogor. Users and visitors actively review three sub-categories of tourist destinations in Bogor.
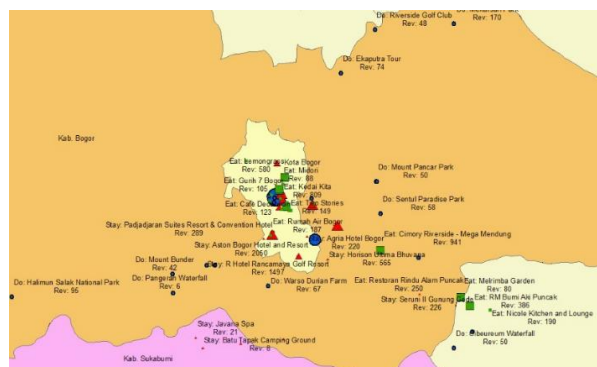

Figure 3. Distribution of Tourism Sites by Category in Bogor

Sukabumi is the smallest city in West Java, nicknamed "Santri City." Data show that the distribution of tourist sites in the "Do" sub-category is even, with the highest number of reviews being less than 100. The "Eat" sub-category is concentrated in urban areas, while the "Stay" sub-category that appears to get reviews is near Ujung Genteng beach, and many are closer to the city of Bogor (Figure 4). This means that attractions, hotels, and restaurants between Bogor City and Sukabumi are thought to complement each other. The distribution is quite even, with the number of reviewers under 400 users and visitors.
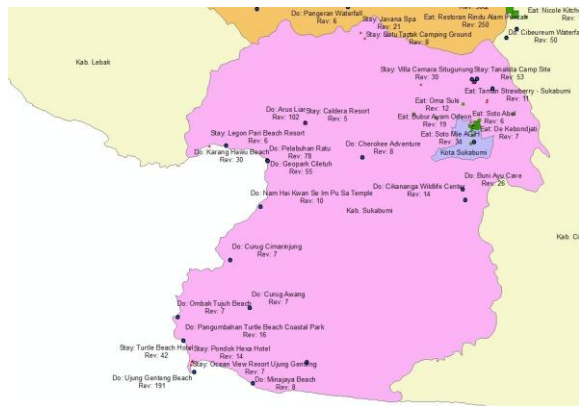
Figure 4. Distribution of Tourism Sites by Category in Sukabumi

Bandung, a city in West Java province, ranks third in size after Jakarta and Surabaya, earning the nicknames Flower City and Paris Van Java. Bandung is an attractive shopping and tourism city with many old buildings with Dutch-style architecture. It also has many public spaces, such as city parks. Bandung receives the highest rating in the "Do" sub-category. It is called the Trans Studio Mall. Hotel Padma is the "stay" sub-category, while Hummingbird Restaurant is the "eat" sub-category. The data also shows that all sub-categories are centered in urban areas and spread close to Subang. We discovered that three sub-categories in the Bandung Regency area appear absent from the map. Users and visitors have not traveled to Bandung Regency much or reviewed the destination (Figure 5).
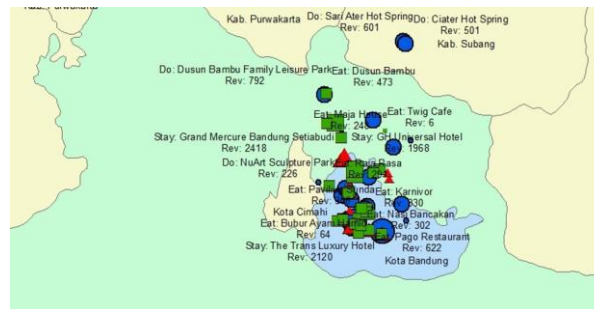

Figure 5. Distribution of Tourism Sites by Category in Bandung

Garut, or Kota Intan, means Beautiful, Orderly, Safe, and Comfortable City. In addition to the Kota Intan, Garut has a nickname, Swiss van Java. Garut is geographically close to Bandung City, the capital of West Java province, and is a buffer zone and hinterland for the development of the Greater Bandung area. The three sub-categories of Garut's tourist destinations are spread evenly, with the number of reviews ranging from 1-215. The "Do" sub-category with the most reviews was Mount Papandayan, the "Stay" sub-category was Fave Hotel Cimanuk Garut, and the "Eat" sub-category was Nasi liwet Pak Asep Strawberry 3. Garut is a city famous for its natural scenery (Figure 6).

Figure 6. Distribution of Tourism Sites by Category in Garut

Cirebon is one of the cities in West Java province, Indonesia. The city is located on the north coast of Java Island, known as the Pantura route, which connects Jakarta-Cirebon-Semarang-Surabaya. In addition to being nicknamed the City of Shrimps, Cirebon is nicknamed the City of the Guardians because of the spread of Islam by one of the Wali Songo. For Cirebon (Figure 7), data shows a tourist destination with three sub-categories centered in Cirebon with several reviews between 6 and 1.105. The "Do" sub-category with the most reviews is Kasepuhan Palace. The "Stay" sub-category with the most reviews is the Aston Cirebon Hotel and the most reviewed in the "Eat" sub-category is Nasi Jamlang Mang Ndull.
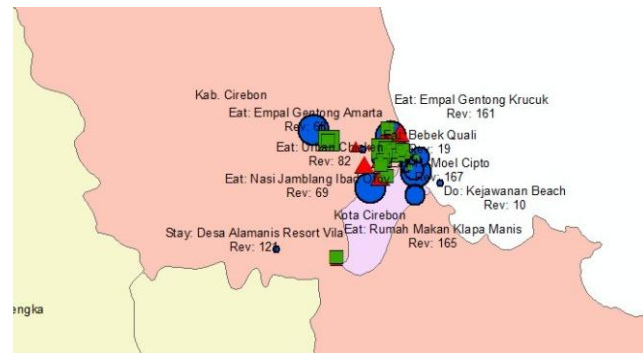

Figure 7. Distribution of Tourism Sites by Category in Cirebon

CONCLUSION

Spatial data can map tourist destinations using social media travel platforms. Location information and reviews are information that can help the government develop strategies to prepare for tourism in its area and help tourists plan tourist trips. Visualization using ArcGIS by combining spatial data and maps will bring up a location plan and several strategies that can be taken as a step to organize tourism in each region. The map of tourist destinations will show a pattern; it needs the effort to distribute visitors evenly, not gather them at one point of destination. Tourism development in West Java Province is planned and developed in an environmentally friendly manner by not depleting or destroying natural and social resources but maintaining them for sustainable use. Refers to the West Java tourism plan, tourist destinations need to create value in a new normal era or future, seeing the potential for natural tourism, which is quite large under the theme of green tourism, which makes visitors greener (ecotourism). Therefore, each city needs to formulate a tourism development plan that aligns with its unique characteristics and leverages data-driven insights into tourism patterns, ensuring that strategies are tailored to local strengths and visitor preferences while supporting sustainable growth.

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