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The Resilience of a Coastal Tourist Destination: An Analysis of Pangandaran's Tsunami Risk

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Abstract

Pangandaran Beach, designated as a Regional Tourism Strategic Area under the Pangandaran Regency Tourism Master Plan 2018–2025, encompasses several key zones, including West and East Beaches, the Nature Reserve Tourism Park, Pananjung Seafood Tourism Centre, and Pananjung Tourist Village. This study investigates the resilience level of the tourism industry within the Pangandaran Beach area by applying a framework of seven tourism resilience elements: 1) Risk Understanding, 2) Business Operations, 3) Disaster Preparedness, 4) Mitigation Planning, 5) Response and Recovery, 6) Infrastructure and Environment, and 7) Governance and Institutions. Seventy tourism industry stakeholders were surveyed using stratified random sampling with a 90% confidence level and a 10% margin of error. The analysis employed descriptive quantitative methods and Importance-Performance Analysis (IPA). Findings reveal that three key resilience attributes fall into the low-performance quadrant: Disaster Mitigation (DM1), Evacuation Planning (DM2), and Building Structure (E1). Despite efforts by the local government and the Regional Disaster Management Agency (BPBD) to promote disaster risk reduction, DM1 and DM2 remain under-implemented due to industry concerns about potentially deterring tourists. Furthermore, E1 remains underdeveloped due to high renovation costs. Although the overall resilience level is moderate, enhancing stakeholder awareness and investment in disaster preparedness is crucial to strengthening the region's capacity to withstand tsunami-related risks.

Keywords: disaster risk reduction, coastal tourism, tourism industry resilience, Pangandaran

INTRODUCTION

Indonesia's geographic position within the Pacific "Ring of Fire" places it among the most disaster-prone countries globally. Situated at the convergence of the Pacific, Eurasian, and Indo-Australian tectonic plates, the nation is regularly affected by geophysical hazards such as earthquakes, volcanic eruptions, and tsunamis. As such, disaster resilience has become a central concern in national development planning. The National Medium-Term Development Plan (RPJMN) 2020–2024 highlights the need to integrate disaster risk considerations, environmental sustainability, and climate change adaptation into regional development strategies.

West Java, Indonesia's most populous province, had a disaster risk index of 125.73 in 2021, placing it in the medium-risk category. Within this region, Pangandaran Regency—located along the southern coast—faces a particularly high exposure to tsunami hazards due to its proximity to the subduction zone between the Indo-Australian and Eurasian plates. The area has experienced several notable seismic and tsunami events, including the devastating 2006 tsunami. Recent simulations suggest that a potential megathrust earthquake of magnitude 8.9 Mw could generate tsunami waves up to six meters along the southern Java coast, reaffirming the urgency of preparedness in coastal regions such as Pangandaran.

As a designated Regional Tourism Strategic Area, the Pangandaran Beach Tourism Area comprises several key attractions, including West and East Beaches, the Nature Reserve Tourism Park, Pananjung Seafood Centre, and multiple tourist villages. The region is a major tourist destination for domestic travellers from

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Bandung, Tasikmalaya, and Garut. However, Pangandaran's tourism growth has been intermittently disrupted by natural disasters. The 2019 Sunda Strait tsunami and the COVID-19 pandemic significantly reduced tourist arrivals, with subsequent recovery further challenged by emerging fears of a megathrust event in 2021. This instability highlights the vulnerability of tourism-dependent communities and businesses in disaster-prone areas. Tourism industry resilience plays a pivotal role in sustaining local economies, protecting livelihoods, and ensuring the long-term viability of destinations. Scholars such as Biggs (in Hall et al., 2018) emphasise that tourism resilience involves not only the capacity of individual businesses to withstand shocks but also the broader adaptive capabilities of communities and destination systems. Disasters can cause severe infrastructure damage, interrupt access routes, and erode tourist confidence (Huang & Min, 2002; Prideaux et al., 2003; Filimonau & De Coteau, 2020). This underscores the importance of enhancing disaster response and recovery mechanisms within tourism planning.

Viewing tourism destinations as complex socio-ecological systems, resilience must be understood as a multi-dimensional construct encompassing economic, social, institutional, and environmental factors (Prayag, 2020). For destinations like Pangandaran, this perspective is essential in developing integrated strategies to strengthen preparedness and recovery capabilities. This study aims to assess the tsunami resilience of the tourism industry in the Pangandaran Coastal Area using Importance–Performance Analysis (IPA). The research offers strategic insights for government agencies, tourism operators, and community stakeholders by identifying priority gaps and high-impact resilience factors. The findings contribute to the growing body of literature on disaster-resilient tourism and provide actionable recommendations for strengthening coastal destination sustainability in the face of increasing disaster risks.

LITERATURE REVIEW

The concept of resilience has evolved from a narrow focus on engineering and environmental systems to a more comprehensive understanding that includes social, economic, and institutional dimensions. In disaster studies, (White and Haas, 1975) pioneered early discussions on resilience, which have since been extended to encompass complex adaptive systems such as communities, infrastructure, and economies. In tourism, resilience has become a critical framework to assess the capacity of destinations and tourism actors to prepare for, absorb, respond to, and recover from hazards. Several resilience frameworks have been developed and applied to tourism settings, especially in coastal and disaster-prone areas. (Farida and Rahayu, 2016), in their study of the Sanur Tourism Area, they adapted the Coastal Community Resilience (CCR) model (United States IOTWS, 2007), which emphasizes social and cultural capacity through seven elements: governance, socio-economic systems, land use and infrastructure, risk knowledge, emergency response, coastal resource management, and disaster recovery. Their findings revealed that most components, especially governance and land use planning, exhibited low resilience. Building on this, (Denitasari, 2019) evaluated business resilience in Pangandaran Regency using a similar CCR framework, uncovering particularly low resilience in disaster recovery and community-level adaptation. Her work called for context-specific indicators and business continuity planning (BCP) tailored to local tourism enterprises.

In a different context, (Usher et al., 2017) assessed tourism business resilience in Virginia Beach using five dimensions: vulnerability, business operations, disaster preparedness, communication, and workforce planning. Similarly, (Cox, 2016) proposed six core elements of tourism resilience—from operations and marketing to institutional support—emphasizing the interconnectedness of tourism systems in disaster situations. Based on a synthesis of the above studies and global best practices (World Bank, 2020; Almutairi et al., 2020), this study adopts an integrated framework of seven key elements of tourism resilience, adapted to the context of coastal tourism areas such as Pangandaran. These elements include: First, Risk Understanding: Refers to access to and use of information about natural hazards, including the ability to assess physical and financial disaster risks. This aligns with (World Bank, 2020), and indicators used by (Farida & Rahayu, 2016; Denitasari (2019).

Secondly, Business Operations: Encompasses core business planning elements—market analysis, operational planning, marketing, and finance—essential for ensuring continuity and adaptive capacity during disruptions (Cox, 2016; Usher et al., 2017). Third, disaster preparedness and mitigation planning include structural and non-structural mitigation, evacuation planning, and community preparedness initiatives (Farida & Rahayu, 2016), and it integrates early warning systems and risk reduction strategies. Fourth, Response and Recovery: Post-disaster actions include communication strategies, asset protection, marketing recovery plans, and restoration of tourism services (World Bank, 2020). Fifth, Infrastructure Resilience: Evaluates the availability and robustness of essential services—healthcare, transportation, utilities, and communication networks—before, during, and after disasters (Almutairi et al., 2020). Sixth, Governance and Institutional

Support: Refers to policy frameworks, institutional actions, regulatory mechanisms, and coordination among stakeholders in managing disaster risks (Almutairi et al., 2020). Seventh, Environmental Management: Focuses on the sustainable use of natural resources and minimizing environmental degradation. Indicators include structural building resilience and coastal pollution control (Almutairi et al., 2020). Broader climate change metrics were excluded due to their macro-scale and limited relevance to local-level indicators.

This seven-element framework serves as the analytical foundation for assessing the tsunami resilience of tourism businesses in the Pangandaran Coastal Area, providing a structured lens through which preparedness and vulnerability can be evaluated.

METHODS

This study adopts a descriptive quantitative research design to measure the resilience level of tourism industry actors in the Pangandaran Beach Area. Both primary and secondary data sources were utilized. Primary data were collected through structured questionnaires, observations, and semi-structured interviews with tourism stakeholders. Secondary data were obtained from institutional records, official statistics, and relevant literature. Before data collection, all respondents were informed about the research objectives, procedures, and their rights as participants. Informed consent was obtained and documented. Anonymity and confidentiality were strictly maintained throughout the research process.

The study was conducted in the Pangandaran Beach Area, encompassing West Beach, East Beach, the Cagar Alam Nature Tourism Park, Pananjung Seafood Center, and Pananjung Tourism Village. The population includes businesses and associations operating in these locations. A purposive sampling technique was employed to ensure representation across key tourism sectors. The sample size was determined using the Lemeshow formula for proportions with a 90% confidence level and 10% margin of error, resulting in 70 respondents. The criteria and distribution of respondents are presented in Table 1.

$$n = \frac{1{,}645^2}{0{,}1}) \, 0{,}5(1 - 0{,}5) = 67{,}6$$

Table 1. Respondent Criteria and Distribution

No	Industry Sector	Criteria	Respondents
1	Tourist Attractions	Located within the strategic zone outlined in the Regional Tourism Master Plan (2018–2025)	4
2	Accommodation (Hotels)	Registered with the Tourism Office; within 500 m from coast; operating > 5 years	14
3	Restaurants/Cafés	Registered; within 500 m from coast; operating > 5 years	19
4	Business Groups	SMEs such as souvenir sellers, water sports, and vehicle rentals, located < 500 m of the coast	26
5	Tour Guide Association	Registered with the Indonesian Tour Guide Association; experience > 5 years	7
	Total		**70**

Source: Research data, 2025

A structured questionnaire based on a Likert scale was used to collect data on the perceived importance and performance of tourism resilience indicators. Each item was rated on a 5-point scale, from 1 (Strongly Disagree) to 5 (Strongly Agree), for importance and performance dimensions. A validity test was conducted on individual items using item-total correlation to ensure measurement accuracy. Items were considered valid if r>0.2. Reliability was assessed using Cronbach's Alpha, with α>0.7 indicating internal consistency. Two types of analysis were conducted: 1) Descriptive Statistical Analysis, such as mean, standard deviation, variance, maximum, minimum, skewness, and kurtosis, were used to profile the resilience level of the tourism industry by sector and by indicator. The analysis also included data cleaning and initial screening for outliers and missing values; 2) Importance–Performance Analysis (IPA): The IPA method was applied to evaluate the gap between each resilience element's perceived importance and actual performance. This method positions indicators into four quadrants based on the intersection of their mean importance and performance scores: Quadrant I: Concentrate Here (High Importance, Low Performance); Quadrant II: Keep Up the Good Work (High Importance, High Performance); Quadrant III: Low Priority (Low Importance, Low Performance); Quadrant IV: Possible Overkill (Low Importance, High Performance).

This approach aligns with methodologies used in prior tourism resilience studies (e.g., Orchiston et al., 2016), particularly in post-disaster contexts, to identify critical intervention areas for enhancing destination preparedness.

RESULTS AND DISCUSSION

Destination Profile and Tourism System in Pangandaran

Pangandaran District, located in Pangandaran Regency, West Java Province, encompasses an area of 82.65 km², comprising eight administrative villages: Wonoharjo, Pananjung, Pangandaran, Babakan, Sukahurip, Purbahayu, Sidomulyo, and Pagergunung. As of 2021, the district had a total population of 60,408 residents, with a density of approximately 2,813 people/km². Positioned at a low elevation of 7 meters above sea level, Pangandaran experiences a warm and humid coastal climate with average temperatures ranging from 20.2°C to 37.2°C, and average wind speeds of 0.97 m/s. As a coastal district, the local economy relies on marine resources, with most residents working as fishermen, traders, or tourism service providers. This heavy dependency on coastal ecosystems and proximity to tectonic subduction zones underscores the region's ecological vulnerability and socio-economic exposure to disasters, particularly tsunamis. Recognizing both its tourism potential and disaster risk, Pangandaran has been designated as a Regional Tourism Strategic Area (Kawasan Strategis Pariwisata Daerah – KSPD) in the 2018–2025 Pangandaran Regional Tourism Master Plan. The region's key tourism zones include West and East Beaches, the Nature Reserve Tourism Park (Cagar Alam), Central Seafood, Pananjung Tourism Village, and Bulak Setra Mangrove Ecotourism Area.

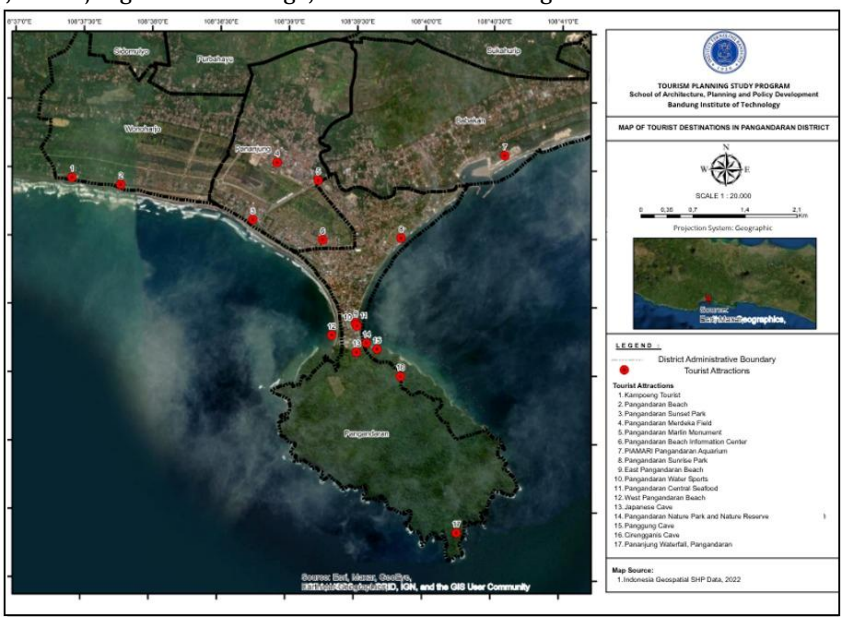

Figure 1. Map of Tourist Attractions in the Pangandaran Beach Area

Source: Research data, 2022

Tourism Attraction Components: The "4A" framework

Attractions

Pangandaran's coastline forms a distinct peninsular geography, offering varied tourist experiences between the West and East Beaches. The West Beach is more accessible and features gentle slopes and calm waves. It is also well-suited for recreational swimming, seafood tourism, and local markets. Meanwhile, East Beach supports more active tourism through fishing, seafood auctions, and cultural events.

Figure 2. West Beach (left) and East Beach Pangandaran Area (right)

Source: Research data, 2023

Table 2. Characteristics of West and East Pangandaran Beaches

Characteristic	West Beach	East Beach
Slope	5–10%	–

Characteristic	West Beach	East Beach
Wave Height	1.25 – 2.50 m (Medium)	1.25 – 2.50 m (Medium)
Length	±7,100 m	±2,900 m
Typology	Marine deposition coast	Marine deposition coast
Supporting Attractions	Culinary tourism, fish market, Bahari Ikan Pindang, Ronggeng dance, sea ceremonies, Japanese cave	Traditional arts, kite festivals, and salted fish markets

Source: Research data, 2023

These contrasting yet complementary characteristics create a diverse tourism portfolio, strengthening Pangandaran's appeal. However, the coastal typology also presents high disaster exposure, particularly due to the flat terrain, which facilitates tsunami wave penetration inland.

Table 3. Tourism Activities in the Pangandaran Beach Area

Location	Existing Activities	Potential Activities
East Beach	Water sports (jet ski, snorkeling, banana boat), fishing, seafood tourism, and fish auction	Squid/clam fishing, windsurfing, boating
West Beach	Swimming, sunbathing, cycling, and seafood culinary tourism	Surfing, nightlife
TWA (Nature Park)	Flora and fauna education, marine biota research, snorkeling, and recreation	–
PIAMARI	Educational tourism, research, and recreation	–

Source: Research data, 2023

Despite these advantages, some high-potential activities remain underdeveloped due to limited investment, infrastructure, or environmental constraints.

Amenities

As a mature tourist destination, Pangandaran provides basic amenities, including 24 accommodation providers and 52 food and beverage establishments, concentrated mainly along the coastal belt. However, this spatial clustering increases the vulnerability of these assets to tsunami hazards, particularly in areas within 500 meters of the shoreline.

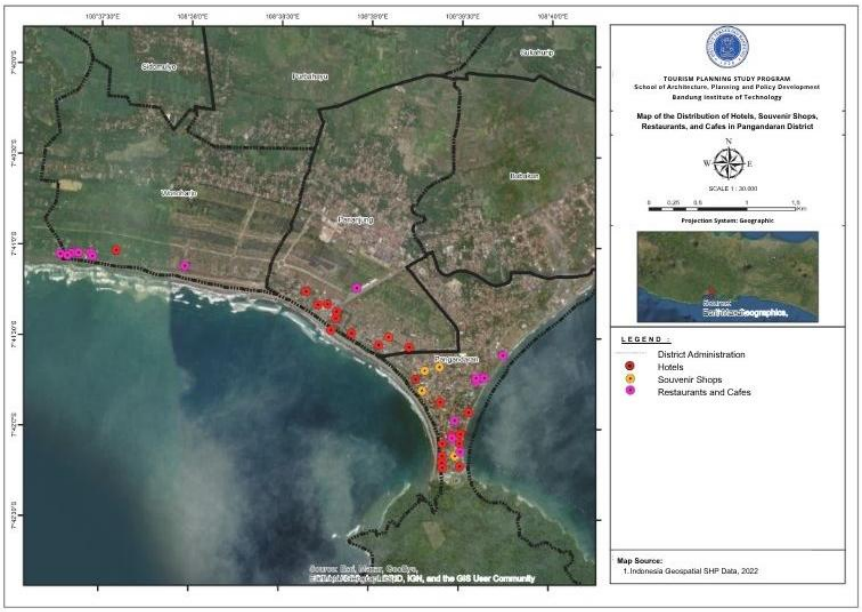

Figure 3. Map of the Distribution of Hotels, Restaurants, Cafés, and Souvenir Shops

Source: Research data, 2022

Accessibility

Accessibility is a crucial factor shaping tourism flow. Pangandaran is reachable by land, air, and rail, though travel durations vary significantly depending on origin. For example, trips from Jakarta or Yogyakarta can take 6–8 hours by land, while direct flights via Susi Air reduce this to under 1 hour.

Table 4. Accessibility to Pangandaran Beach

Route	Transportation	Destination	Travel Time	Distance
Land	Public Bus	Jakarta – Pangandaran	7–8 hours	750 km

Route	Transportation	Destination	Travel Time	Distance
	Public Train	Jakarta – Banjar	8 hours	328.8 km
	Private Car	Jakarta – Pangandaran	6–7 hours	750 km
	Bus Budiman	Bandung – Pangandaran	5–6 hours	236 km
	Public Train	Bandung – Banjar	4–5 hours	155.8 km
	Private Car	Bandung – Pangandaran	4–5 hours	236 km
	Public Bus	Yogyakarta – Pangandaran	6–7 hours	385 km
	Private Car	Yogyakarta – Pangandaran	5–6 hours	385 km
Air	Susi Air Plane	Jakarta – Pangandaran	60 min	750 km
	Susi Air Plane	Bandung – Pangandaran	30 min	236 km

Source: Research data, 2023

While the availability of multiple modes enhances access, transport infrastructure may prove inadequate during emergency evacuation scenarios, particularly for large-scale disaster response.

Tsunami Threat and Institutional Response

Indonesia's southern coastal regions, including Pangandaran Regency, are situated along the Java subduction zone, a highly active tectonic boundary where the Indo-Australian and Eurasian plates converge. This geological setting exposes Pangandaran to significant seismic hazards, particularly megathrust earthquakes capable of generating tsunamis. According to the 2024 Disaster Risk Assessment conducted by the National Disaster Management Agency (BNPB), Pangandaran scored 11.01 on the tsunami hazard index, classifying it as medium risk. However, in the broader West Java Provincial Risk Assessment, Pangandaran is placed in the high vulnerability category due to its low elevation, high population density, and heavy reliance on coastal economic activities. In response to this risk, the Pangandaran government enacted Regional Regulation No. 21 of 2016 on Disaster Management, which mandates a coordinated, sustainable, and community-based approach to disaster risk reduction. This regulation aligns with national disaster legislation, including Law No. 24/2007 on Disaster Management and Government Regulation No. 21/2008 on implementing disaster mitigation. It mandates local governments to establish clear disaster governance protocols across the pre-disaster, emergency, and post-disaster phases.

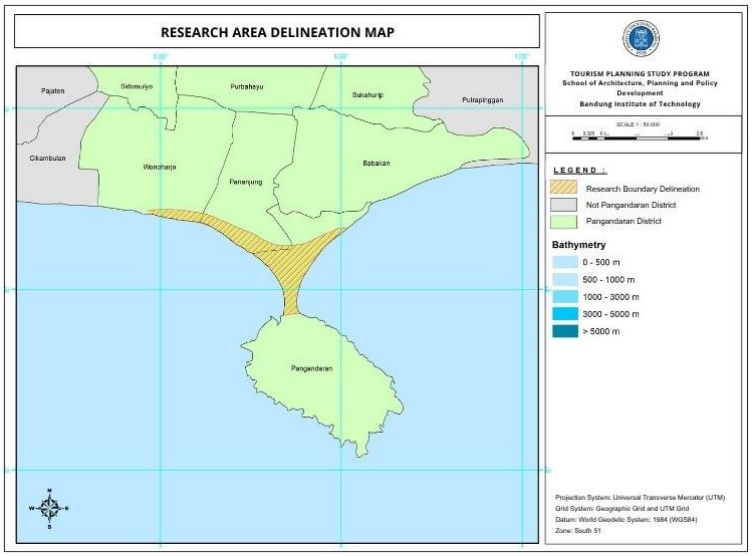

Figure 4. Research Area Delineation Map

Source: Research data, 2023

Pangandaran has since emerged as a regional disaster preparedness model, particularly in developing tsunami-resilient villages (desa tangguh bencana). The local government has engaged multi-stakeholder collaboration with provincial authorities, NGOs, and local tourism actors to conduct public education, early warning system development, and community training. These initiatives aim to enhance the region's capacity for risk communication, evacuation readiness, and post-disaster recovery—key components of tourism resilience frameworks (Prayag, 2020; Orchiston et al., 2016). To operationalize its disaster governance, the Regency follows a series of Standard Operating Procedures (SOPs) derived from national and regional laws: 1) Pre-disaster SOPs: include hazard mapping, early warning infrastructure, and public awareness campaigns; 2) Emergency response SOPs: cover coordination protocols, evacuation procedures, and rapid response

mechanisms; 3)Post-disaster SOPs: emphasize damage assessment, reconstruction, and livelihood recovery. These SOPs are also aligned with broader regulatory instruments, such as Regulation of BNPB No. 15/2012 (Disaster Control Center Guidelines); BNPB Regulations No. 9 & 10/2008 (Rapid Response and Emergency Command Procedures); Regional Regulation No. 31/2016 (Institutional Structuring of Pangandaran's Disaster Management Agencies).

The map in Figure 4 delineates the specific research area along the Pangandaran Coastal Zone, marked in shaded orange, representing the highest-risk tsunami exposure area. The map includes the administrative boundaries of the affected villages—Sidomulyo, Wonoharjo, Pananjung, and Babakan—which are located directly adjacent to the shoreline. These areas are topographically flat with a low gradient, enabling tsunami waves to travel inland significantly, amplifying the destruction radius during seismic events. The area's physical geography—characterized by marine deposition, coasts, and dense tourism infrastructure—further elevates the risk. Physical exposure and economic concentration along the coast necessitate high preparedness, particularly for tourism stakeholders.

Resilience of the Coastal Tourism Sector in Pangandaran

The resilience of the Pangandaran tourism industry was assessed across a composite of indicators reflecting stakeholder preparedness, adaptability, and recovery capacity in the face of tsunami risk. Based on responses from 70 tourism businesses and associations, the results show an average resilience score of 3.01, placing the sector in the moderate resilience category (Table 5). Distribution across categories reveals a near-even split between high (29.9%) and low resilience (29.8%), with 40.2% of respondents falling within the medium category.

Table 5. Resilience Classification of the Coastal Tourism Industry

Resilience Category	Frequency	Percentage
High (X > 3.95)	1,656	29.9%
Medium (2.07 < X < 3.95)	2,225	40.2%
Low (X < 2.07)	1,649	29.8%
Mean	—	**3.01**
Standard Deviation	—	**0.94**

Source: Research data, 2023

This average suggests a moderate overall ability of the tourism industry to anticipate and respond to tsunami-related disasters, yet with a significant portion of actors either underprepared or highly vulnerable. This fragmentation signals unequal access to disaster-related knowledge, planning mechanisms, and recovery strategies.

Resilience Across Tourism Sectors

Resilience levels differ substantially across tourism sub-sectors (Table 6). The Tourist Attractions (DT) and Tour Guide Associations (KP) demonstrate the highest levels of resilience, both in terms of mean score and proportion of actors in the "high" category. By contrast, Restaurants & Cafés (RM-CF) and Small Business Groups (KU) show lower resilience, with 72.3% of responses falling below the high-resilience threshold combined.

Table 6. Resilience by Type of Tourism Actor

Tourism Actor	High (%)	Medium (%)	Low (%)	Avg. Resilience
Tourist Attractions (DT)	60.1%	26.3%	13.6%	**3.56**
Tour Guide Associations (KP)	58.1%	24.6%	17.4%	**3.51**
Hotels (AKH)	33.1%	45.1%	21.8%	3.12
Business Groups (KU)	22.1%	44.8%	33.1%	2.82
Restaurants & Cafés (RM-CF)	21.7%	39.0%	39.2%	**2.79**

Source: Research data, 2023

Figure 5 visualizes these differences, highlighting the unequal distribution of adaptive capacity across the tourism system. Tour guide associations benefit from strong institutional linkages and information networks, enhancing their capacity for coordinated action. In contrast, informal or micro-scale businesses often lack organizational resilience, formal training, and access to contingency planning—consistent with findings by (Denitasari, 2019; Prayag, 2020).

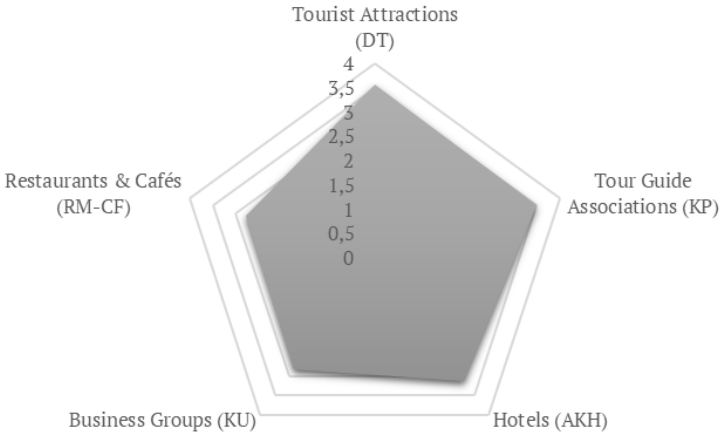

Figure 5. Resilience Levels by Tourism Actor

Source: Research data, 2023

Improving resilience in sectors like restaurants and business groups thus requires technical interventions and social capital strengthening, such as creating cross-sectoral associations, joint response planning, and shared resource networks.

Resilience by Thematic Dimensions

Resilience was further disaggregated across seven dimensions (Table 7), each representing a key pillar in the tourism resilience framework. Understanding Risk (UR) scored the highest, with a mean of 3.58, suggesting that risk awareness is well-established. However, this awareness does not consistently translate into action, as seen in the low scores for Response and Recovery (RR = 2.53), Infrastructure (I = 2.70), and Disaster Mitigation (DM = 2.71).

Table 7. Resilience by Thematic Dimension

Dimension	High (%)	Medium (%)	Low (%)	Avg. Resilience
Understanding Risk (UR)	51.9%	39.0%	9.1%	**3.58**
Business Operations (BO)	49.0%	40.4%	11.6%	3.40
Governance (G)	40.2%	33.3%	26.5%	3.23
Environment (E)	17.0%	47.9%	35.1%	2.80
Disaster Mitigation (DM)	21.4%	41.4%	37.2%	2.71
Infrastructure (I)	13.9%	41.7%	44.4%	2.70
Response and Recovery (RR)	9.6%	34.8%	55.6%	**2.53**

Source: Research data, 2023

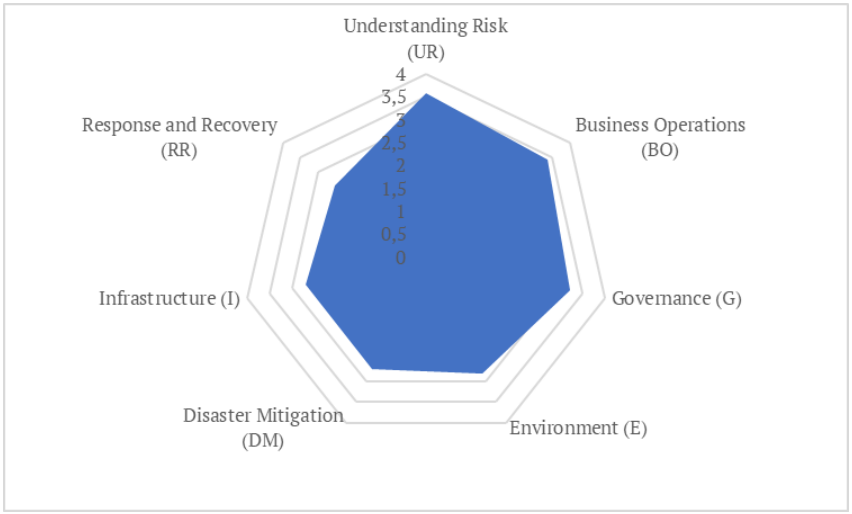

Figure 6. Average Resilience by Dimension Compared to Overall Mean

Source: Research data, 2023

As illustrated in Figure 6, UR, BO, and G all perform above the average, indicating strong cognitive and managerial preparedness. In contrast, the weak performance in RR, DM, I, and E dimensions underscores a lack

of actionable planning, investment in infrastructure, and environmental resilience efforts. This gap between awareness and operationalization is a key insight in tourism resilience literature. (Prayag, 2020) suggests that destinations with high cognitive resilience but low structural or procedural resilience remain highly vulnerable to external shocks. These findings imply that resilience-building efforts in Pangandaran must move beyond awareness campaigns, toward tangible implementation mechanisms, such as evacuation planning, infrastructure audits, and financial incentives for mitigation upgrades.

Importance–Performance Analysis (IPA) of Tourism Resilience Factors

An Importance–Performance Analysis (IPA) was conducted to identify priority areas for resilience enhancement. This method enables mapping tourism resilience attributes into four quadrants based on respondents' perceptions of their importance and actual performance. Figure 7 illustrates this distribution, plotting each attribute relative to the overall means of importance and performance.

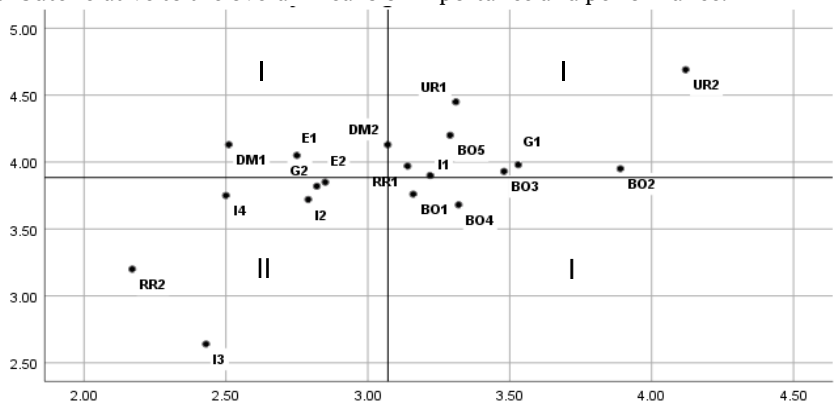

Figure 7. Importance–Performance Matrix of Resilience Factors

Source: Research data, 2023

The IPA framework, frequently used in tourism risk management studies (e.g., Orchiston et al., 2016), effectively identifies perception-action gaps among tourism actors. In disaster-prone destinations such as Pangandaran, it highlights attributes that require immediate intervention versus those that are over-emphasized or under-prioritized.

Quadrant I: "Keep Up the Good Work" – High Importance, High Performance

This quadrant includes attributes that stakeholders consider critical and are already performing well. These are key strengths that should be maintained and reinforced. Included attributes: UR1, UR2 (Risk Knowledge); BO2 (Market Analysis); BO3 (Marketing Plan); BO5 (Financial Planning); I1 (Health Services); RR1 (Marketing and Communication Strategy), and G1 (Laws and Policies). These findings reflect a relatively strong cognitive and managerial foundation among tourism actors. For example, BO2 and BO3 show that businesses know market dynamics and can adapt promotional strategies accordingly. Similarly, the high performance of RR1 demonstrates growing capabilities in communication during crises, often leveraging social media to disseminate information. The G1 result also implies that actors are aware of relevant legal frameworks and understand their implications in the context of disaster risk reduction (DRR).

Quadrant II: "Possible Overkill" – Low Importance, High Performance

Attributes in this quadrant show good performance but are perceived as less important. These may indicate inefficient allocation of attention or resources. BO1 (Industry Analysis) and BO4 (Operational Planning) included attributes. These dimensions are likely already embedded in daily operations and, thus, deprioritized by respondents. However, consistent re-evaluation of industry structure and operational agility remains essential, particularly under dynamic risk scenarios.

Quadrant III: "Low Priority" – Low Importance, Low Performance

These attributes represent areas with minimal perceived urgency and correspondingly low implementation. While not immediately critical, they may pose long-term challenges if neglected, particularly under cascading hazard scenarios. Included attributes: RR2 (Asset Protection and Recovery); I2–I4 (Transportation, Utilities, Communication); G2 (Institutional Action), and E2 (Coastal Pollution Control). The relatively poor perception of RR2 indicates that many tourism businesses underestimate the importance of physical asset recovery, likely

due to tsunamis' low frequency but high-impact nature. Infrastructure elements (I2–I4) are also rated as less important, possibly reflecting limited access to alternative systems (e.g., backup transportation or emergency communication tools). Coastal environmental indicators (E2) are largely ignored due to high implementation costs, such as the installation of wastewater treatment or certification. This aligns with findings by (Denitasari, 2019), which showed that coastal resource management was among the lowest performing components of tourism resilience in Pangandaran.

Quadrant IV: "Concentrate Here" – High Importance, Low Performance

This quadrant represents the most strategically critical attributes for immediate intervention. These are perceived as essential yet are currently under-implemented. Included attributes: DM1 (Disaster Mitigation Measures), DM2 (Evacuation Planning), and E1 (Building Structure Resilience). Despite ongoing efforts by local authorities to mainstream DRR into the tourism sector, these attributes remain weak due to a combination of factors: DM1 & DM2: Signage, evacuation maps, and standard operating procedures are poorly implemented or inconsistently maintained. Some stakeholders avoid displaying evacuation maps for fear of deterring visitors—illustrating a tension between perceived safety and tourism image; and E1: Many tourism structures were built without disaster-resilient standards. High retrofitting costs and a lack of regulatory enforcement are major barriers. These gaps reflect the implementation paradox discussed by (Prayag, 2020)—where stakeholders acknowledge risk but fail to act due to economic constraints, social perceptions, or institutional inertia.

Implications

The IPA results underscore a critical insight: while risk understanding and business planning are relatively strong, technical preparedness and physical infrastructure remain vulnerable. For policymakers, this suggests the need to: 1) Reframe disaster mitigation as marketable safety assurance, not as threat marketing; 2) Provide financial incentives or subsidies for upgrading infrastructure; and 3) Strengthen enforcement of building codes and evacuation SOPs. Bridging the gap between perceived importance and actual performance, particularly in Quadrant IV attributes, is essential for holistic tourism resilience.

Strategic Recommendations for Enhancing Tourism Industry Resilience in Pangandaran

Based on the findings from the Importance–Performance Analysis (IPA), three key attributes fall into the critical priority quadrant (Quadrant IV)—namely: Disaster Mitigation (DM1), Evacuation Planning (DM2), and Building Structure Resilience (E1). Tourism stakeholders perceive these elements as highly important, yet they demonstrate low actual performance, underscoring a significant implementation gap within the coastal tourism sector of Pangandaran. To address these gaps, a multi-layered resilience strategy is proposed. This framework is designed to be actionable, stakeholder-inclusive, and aligned with local government regulations and international best practices in tourism disaster risk reduction (e.g., UNDRR, 2019; Orchiston et al., 2016).

Table 8. Strategic Actions to Enhance Resilience in the Pangandaran Coastal Tourism Industry

Objective	Strategy
Disaster Mitigation	1) Development and Implementation of SOP (Standard Operating Procedure). • Pre-Disaster SOPs include routine checks of early warning systems, safety equipment inspections, and emergency logistics management. • During a Disaster, SOPs: detailed procedures on actions to take during an earthquake or tsunami, including personal protective equipment and emergency communication channels. • Post-Disaster SOPs, guidelines for rapid damage assessment, incident reporting, and initial recovery steps. 2) Integrated Training and Simulation Program, such as: • Mandatory Role-Based Training for management team, security & technical staff, and frontline staff • Conducting Routine Simulations • Increasing team awareness and skills through Inter-Business Unit Mitigation Competitions 3) Communication and Early Warning Systems • Improving effective Communication and Early Warning Systems, such as implementing a centralized Warning System Integration • Have Internal Communication Channels for fast and responsive coordination • Increasing visitor awareness by providing safety information 4) Equip each area with standard safety and security equipment such as: a light, a fire extinguisher (APAR), a first aid kit, an emergency flashlight, and a megaphone.

Objective	Strategy
Evacuation Plan	1) Preparation of Evacuation Plans and Routes by mapping and facilitating access for vulnerable groups 2) Installation of Standard Evacuation Signage (TES) that is easily visible, reflective (glows in the dark), and uses universal symbols. 3) Formation of an Evacuation Team responsible for guiding the evacuation
Building Structure	1) Earthquake and Tsunami Resistant Building Construction 2) Periodic Structure Audit and Maintenance 3) Ensure all property and building assets are protected against natural disasters.

Source: Research data, 2023

Discussion

The findings of this study underscore the complex interplay between perceived risk, structural vulnerabilities, and institutional capacity in shaping the resilience of tourism actors in coastal disaster-prone regions. In the case of Pangandaran, while awareness of tsunami risk is relatively high—particularly among tourism associations and tourist attraction managers—this has not translated into adequate preparedness or mitigation behaviors across the broader sector, as previous research related to tourism destination development and risk (Nurlaila et al., 2021; Prawira et al., 2024; Boediman et al., 2025). A critical insight is the uneven distribution of resilience across different tourism actors. Tourist attractions and formal associations show higher levels of resilience (mean scores of 3.56 and 3.51, respectively), whereas restaurants, cafés, and informal business groups exhibit significantly lower resilience levels. This supports existing literature (e.g., Orchiston et al., 2016; Becken & Hay, 2012) that suggests smaller, less-organized tourism enterprises often lack the institutional capacity, financial resources, or formal disaster governance mechanisms to adapt effectively to risk.

Moreover, the IPA results highlight a pronounced risk–action gap. Attributes such as Disaster Mitigation, Evacuation Planning, and Building Structure are considered critically important, yet demonstrate poor implementation. This finding aligns with risk normalization theory (Slovic, 1987; Wisner et al., 2004), where familiarity with risk conditions—such as frequent but non-destructive tremors—leads to desensitization and underpreparedness. In the context of Pangandaran, it appears that while the community acknowledges the potential for tsunamis, this acknowledgment does not trigger sustained or institutionalized action. The disparity between theoretical resilience frameworks and practical implementation can also be attributed to governance fragmentation. While multiple regulatory instruments are in place (e.g., Regional Regulation No. 21/2016, Law No. 24/2007), coordination between government, private sector, and community remains sporadic. As (Biggs et al., 2012) argue, resilience is not solely about absorbing shocks but about developing adaptive governance and learning systems—areas in which Pangandaran's tourism sector still faces challenges.

Theoretical Implications

This study contributes to the growing body of literature on tourism disaster resilience, particularly in the context of emerging economies and small-scale coastal destinations. It reinforces the multi-dimensional nature of resilience (UR, BO, DM, RR, I, G, E), suggesting that resilience should not be viewed as a binary condition (resilient vs. non-resilient), but rather as a spectrum shaped by a combination of: 1) Knowledge and perception (Understanding Risk); 2) Organizational planning (Business Operation); 3) Governance integration (Government & Institutional Capacity); and 4) Physical infrastructure (Infrastructure & Environment). The findings further suggest refining resilience assessment models in tourism by incorporating behavioral components—specifically, how tourism actors perceive, interpret, and act upon risk. Traditional frameworks often assume rational actor models; however, this study shows that emotional, economic, and cultural considerations significantly influence preparedness behavior. Regarding theory development, the study supports the integration of risk normalization and implementation gap literature into resilience frameworks. This calls for expanding resilience theory beyond system robustness to include cognitive and organizational inertia as key limiting factors.

Practical Implications

From a policy and managerial perspective, several practical implications emerge: 1) Targeted Capacity Building: Training programs should focus on low-resilience segments such as restaurants, cafés, and informal businesses. Government agencies and tourism associations could co-develop modular disaster preparedness toolkits tailored to different business sizes and capacities. 2) Incentive-Linked Compliance: Current regulations lack enforcement and do not offer tangible benefits for compliance. Introducing incentive structures—subsidies for building reinforcement, reduced taxes for certified disaster-resilient businesses, or

priority marketing on government tourism platforms—could motivate more widespread adoption of preparedness measures. 3) Integrated Risk Communication Systems: There is a need for centralized, multi-channel early warning systems that connect BPBD, tourism operators, and visitors. Clear signage, mobile alerts, and multilingual guides can enhance tourist safety without diminishing destination appeal. 4) Formalization of Informal Actors: Informal businesses, representing a significant portion of Pangandaran's tourism economy, are largely excluded from current disaster governance mechanisms. Efforts to formalize and federate these actors into local business groups or cooperatives could improve access to training, funding, and policy engagement. 5) Embedding Resilience into Destination Branding: Rather than viewing disaster risk as a liability, Pangandaran could adopt a "safe destination" branding strategy—highlighting preparedness, safety protocols, and community readiness as competitive differentiators in the domestic and international tourism market.

CONCLUSION

This study assessed the disaster resilience of the tourism industry in the Pangandaran Coastal Area by analyzing 19 attributes across seven key dimensions: Risk Understanding, Business Operations, Disaster Mitigation, Response and Recovery, Infrastructure, Governance, and Environment. Using descriptive statistics and Importance-Performance Analysis (IPA), the findings indicate that the overall resilience level remains in the moderate category (Mean = 3.01; SD = 0.94), with 40.2% of respondents demonstrating medium resilience, 29.9% high, and 29.8% low. Three critical attributes emerged as priority areas requiring urgent attention due to their high importance but low performance: 1) Disaster Mitigation (DM1); 2) Evacuation Plan (DM2); and 3) Building Structure (E1). Tourist Attractions (Mean = 3.56) and Tour Guide Associations (Mean = 3.51) show relatively strong resilience capacities among tourism actors. In contrast, Restaurants & Cafés (Mean = 2.79) and Business Groups (Mean = 2.82) lag, largely due to limited organizational structures, inadequate access to risk information, and insufficient preparedness mechanisms.

These results highlight a risk-perception-to-action gap, where awareness of disaster risks does not consistently lead to proactive adaptation. Structural constraints—such as limited financial resources, regulatory enforcement, and concerns over visitor deterrence—hinder effective mitigation and preparedness strategies. To strengthen resilience in high-risk coastal tourism areas like Pangandaran, the following strategic interventions are recommended: 1) Standardization and enforcement of disaster-related SOPs across all phases (pre-, during-, and post-disaster); 2) Comprehensive evacuation planning, including inclusive route mapping, signage installation, and evacuation team formation; 3) Periodic structural audits and retrofitting of tourism facilities to meet earthquake- and tsunami-resilient standards; 4) Integration of centralized early warning systems and communication protocols; 5) Capacity building through simulations, role-based training, and cross-sectoral coordination.

This study contributes to the literature on tourism resilience by operationalizing a contextualized resilience framework adapted to disaster-prone coastal destinations. However, it is limited to one geographic region and is primarily quantitative. Future research should incorporate longitudinal approaches, integrate stakeholder-based qualitative data, and explore the role of digital and financial resilience in small and medium-sized tourism enterprises. A coordinated effort between local governments, industry associations, and community stakeholders is essential to transition from reactive responses to proactive resilience-building—ensuring the safety of tourists and workers and the long-term sustainability of coastal tourism economies.

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