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Prioritization of Risk Factors in Sea-Island Tourism: A Study in Quang Ngai Province, Vietnam

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Abstract: The prioritization of risks associated with sea-island tourism activities in Quang Ngai Province, Vietnam, was conducted through a structured multi-criteria decision-making (MCDM) framework. An integrated methodology combining the Analytic Hierarchy Process (AHP) and Pareto analysis was employed to systematically identify and rank critical risk factors. Risk criteria were initially identified through expert consultations involving professionals with extensive experience in sea-island tourism and destination management. These criteria were then evaluated using the AHP method to determine their respective overall weights. Subsequently, Pareto analysis was applied to classify the most impactful risk categories requiring immediate attention. The findings indicate that the top four priority risks include accidents, damages caused by natural disasters and extreme weather events, outbreaks of infectious diseases, and broader implications of climate change. These risks exhibited overall weight values ranging from 0.1061 to 0.3315, underscoring their dominant influence on tourism sustainability and safety. This prioritization offers essential insights for policymakers, destination managers, and tourism planners in the formulation of effective risk mitigation strategies. The integrated AHP-Pareto approach demonstrated in this study contributes a replicable model for the proactive management of tourism risks in coastal and island contexts, where ecological sensitivity and visitor safety are of heightened concern.

Keywords: Analytic Hierarchy Process; Pareto analysis; Risk prioritization; Sea-island tourism; Coastal tourism management; Quang Ngai Province; Vietnam

1. Introduction

Quang Ngai is a coastal province located in the north of the South Central Region, Central Vietnam. It has a coastline of about 129 km (Pham & Saizen, 2023). This is a place with a large territorial sea of 11,000 km² and six estuaries rich in seafood resources with many beautiful beaches. Quang Ngai is located in the key economic region of the South Central Region. With a coastal location featuring islands, an extensive shoreline, and rich tourism potential, especially sea and island tourism with famous destinations such as Ly Son Island, My Khe Beach, Dung Quat Bay, Sa Huynh, and Ganh Yen, this is an opportunity as well as a driving force for Quang Ngai to develop the marine economy. Sea and island tourism is also among those potentials; it can bring the province a source of revenue for the budget as well as a source of income for the people.

Recently, the People's Committee of Quang Ngai Province has launched a project to develop and position Quang Ngai tourism through 2025, with a vision toward 2030, emphasizing the potential of sea-island tourism. Accordingly, the province makes efforts to develop, build, and position its tourism brand based on the unique characteristics and core values of sea-island resources and Sa Huynh culture. In particular, Ly Son Island has been chosen as the core with the characteristics of marine volcanoes. The locality focuses on developing tourism activities to bring visitors new experiences of Quang Ngai with pristine sea and islands, unique geology, and diverse and distinctive culture (Vinh & Thanh, 2024). To implement that policy, it is necessary and urgent to review and consider all risks in sea-island tourism activities. This work aims at sustainable development for Quang Ngai tourism in general and sea-island tourism in particular.

Risks manifest differently depending on the context. However, regardless of the context, risks can be understood in the most general way. They are constant challenges that every business has to face (Bortey et al., 2022). Risks can be considered as things that have an objective negative direction, but most of them are perceived in a rather subjective way; they are interpreted and determined based on the past experience and values of a specific individual (Akyüz et al., 2021). Risk management is a task that every business should pay attention to if it wants to maintain stable and sustainable development. Effective risk management is one of the most important tasks to help businesses maintain stable financial stability in operations as well as finance (Malempati, 2022). By paying attention to risk management, a business can reduce the possibility of large unfavorable cash flow shortages (Nocco & Stulz, 2022). One of the important tasks of risk analysis includes prioritizing risks. Once identified, risks will be prioritized based on one or more parameters. Classical risk analysis is often based on a combination of two aspects: probability and impact (Marle, 2020). This raises a clear and important issue for public managers as well as private enterprises in the tourism industry in Quang Ngai, which is not only to identify risks but also to find a reasonable and appropriate way to prioritize the high-impact risks.

Existing risk studies in many fields often use different methods to prioritize risks. Salah et al. (2023) used the Failure Mode and Effects Analysis (FMEA) method to prioritize risks in the manufacturing process in the era of Industry 4.0. Zeng et al. (2021) innovatively used Neural Networks (NN) and Probabilistic Logic Programming (PLP) techniques to prioritize risks in computer network systems. Jafarzadeh Ghoushchi et al. (2023) applied a combination of Step-wise Weight Assessment Ratio Analysis (SWARA) and Measurement of Alternatives and Ranking according to Compromise Solution (MARCOS) methods for risk prioritization in road safety. Da Silva et al. (2020) applied the Geographic Information System (GIS) method to prioritize urban flood risks. Zaidi & Hasan (2022) used AHP for risk prioritization in the automotive supply chain. In addition, Dagsuyu et al. (2021) applied AHP with FMEA to prioritize risks in the cold chain. However, many gaps still exist in tourism research on risks.

A combination of AHP and Pareto analysis was applied in this study to prioritize risks in sea-island tourism activities in Quang Ngai, Vietnam. AHP is a method commonly used in MCDM by determining the priority level between criteria (Chan et al., 2004). AHP is also used to determine aggregate priorities from alternatives related to many different criteria (Saaty, 2003). Pareto analysis brings many important benefits to organizations; it helps to identify and prioritize the most important issues/tasks, thereby optimizing resources and improving operational efficiency (Karuppusami & Gandhinathan, 2006). The study is expected to help public managers and private enterprises in the tourism industry identify risks that need to be prioritized, thereby enhancing the effectiveness of public management and increasing the efficiency of business operations, as well as contributing to the sustainable development of the sea-island tourism sector in Quang Ngai.

2. Literature Review

AHP has been used in many studies of risks. Gaudenzi & Borghesi (2006) used AHP in supply chain risk management. Aminbakhsh et al. (2013) performed a safety risk assessment using AHP in budget planning for projects in the construction sector. Raka & Liangrokapart (2017) applied AHP for risk analysis in the development of new generic drugs. Ghosh & Kar (2018) applied AHP to assess flood risk in Malda, India. Sales et al. (2020) performed risk assessment in inventory management using AHP. Koulinas et al. (2021) performed risk prioritization in a desalination plant construction project using AHP.

In addition, some studies have applied AHP in combination with other methods in risk studies. For example, Palchaudhuri & Biswas (2016) used a combination of AHP and GIS in analyzing drought risk assessment in Puruliya, India. Pathan et al. (2022) assessed flood risks in Navsari, India, by using AHP and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). Jaberidoost et al. (2015) used two methods, analytic hierarchy analysis and Simple Additive Weighting (SAW), for risk assessment in the pharmaceutical supply chain in Iran. Ramavandi et al. (2021) used the integrated AHP and VIKOR (a multi-criteria optimization and compromise solution) in environmental risk assessment. Yazo-Cabuya et al. (2024) prioritized organizational risks by applying a combination of Decision Making Trial and Evaluation Laboratory (DEMATEL) and AHP. Many studies in the tourism industry have examined different aspects. Utama et al. (2024) conducted a review of the impact of overtourism in Bali in the context of sustainable development. Yue & Li (2024) conducted a behavioral study by analyzing the effects of short video content related to tourism on users' travel intentions. Nguyen & Tuyen (2024) conducted a study on human resources in the tourism industry by considering the selection of tour guides. In addition, Subakti et al. (2024) conducted an analysis and evaluation to provide solutions for improving customer satisfaction and loyalty at heritage hotels in Indonesia.

Several studies have highlighted the risks related to tourism. Neacşu et al. (2018) studied the impacts of geopolitical risks on tourism. Asgary & Ozdemir (2020) analyzed the global risk and tourism in Turkey. Abd Mutalib et al. (2016) addressed risks in the context of medical tourism. Balcilar et al. (2024) analyzed tourism development and energy security risks in the United States using the Kernel-based Regularized Least Squares (KRLS) machine learning. Tu et al. (2024) studied the impact of environmental risks from carbon emissions in tourism activities in China. Several studies have highlighted the impact of climate change on tourism. Hsu &

Sharma (2023) addressed the risk management of outdoor tourism activities in the context of climate change. Scott & Gössling (2022) provided an overview of tourism studies and tourism activities in the face of climate change. Chikodzi et al. (2022) studied the impacts of climate change on heritage tourism sites in national parks in South Africa. Pandy & Rogerson (2021) addressed coastal tourism in the context of climate change in the South African parkway.

A combination of the AHP method and Pareto analysis was applied in this study to prioritize risks in sea-island tourism activities in Quang Ngai Province, Vietnam. The AHP method was applied to determine risk criteria, calculate the criteria weight. Then Pareto analysis was applied to determine the risk criteria that need to be prioritized. This combination shows the superiority and benefits of Pareto in research in general and risk research in particular.

3. Methodology

3.1 Research Process

To prioritize risks in island tourism activities in Quang Ngai Province, Vietnam, the study applied a combination of the AHP method and Pareto analysis. Figure 1 shows the basic steps of the research process.

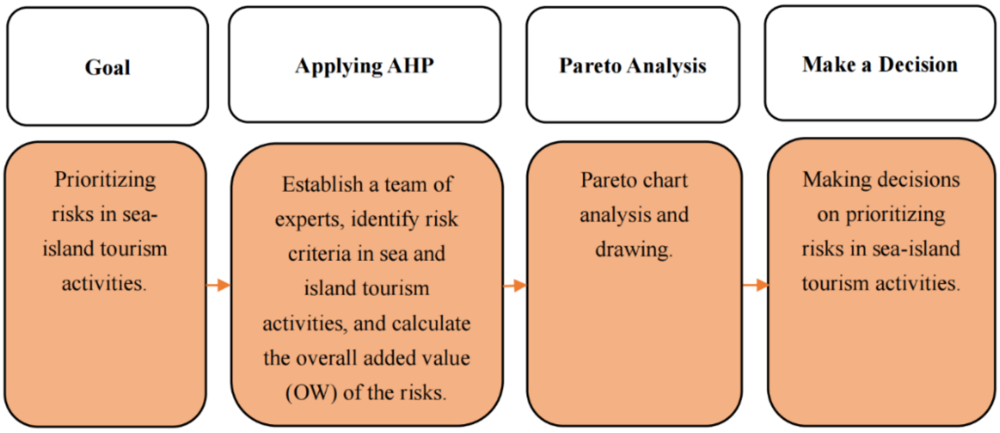

Figure 1. Research framework

3.2 Analytic Hierarchy Process (AHP)

AHP is one of the commonly used methods in popular decision-making; it can solve complex, multidimensional problems (Aziz et al., 2016). In MCDM, the use of the AHP method can be considered a highly effective solution (Canco et al., 2021). AHP promotes MCDM through a logical framework (Dolan, 2008). AHP is an MCDM method that uses pairwise comparison of criteria to perform ranking, with this approach related to the Consistency Ratio (CR) (Asadabadi et al., 2019). CR has a great impact on the ranking of criteria or the reversal of this ranking (Raharjo & Endah, 2006). One of the benefits of the AHP method is that it helps managers or decision-makers convert subjective emotional judgments into scientifically based, objective measures (Bhushan & Rai, 2004).

According to the study by Al-Harbi (2001), the basic steps of the AHP implementation are as follows:

Step 1: In the first step, the problem and the goal of decision-making must be identified.

Step 2: The importance of each pair of criteria is compared.

Step 3: The weight of the criteria is calculated by considering their consistency.

Step 4: A decision is made.

In this study, the implementation of AHP involves the third step. The final step of AHP is to make a priority decision based on the results of the analysis by drawing the Pareto chart.

In the first step in this study, a group of experts was established and a detailed and careful focus group discussion was conducted with experts in the tourism industry in Quang Ngai Province on the risk criteria in sea-island tourism activities. As a result, the experts agreed to divide the risks in sea-island tourism activities into three main groups (business risks, safety risks, and environmental risks), with each group being an entity related to sea-island tourism activities. The first and second groups are related to tourists. The last group is related to the external entity, which is the natural environment. As for the three first-level risk groups, the corresponding second-level risks were identified in this study. Then the experts compared each pair of risk criteria. The comparison of the importance of each pair of risk criteria was based on the importance scale, as shown in Table 1. The list of the two-level risk criteria and the hierarchy model are shown in Figure 2 and Table 2, respectively.

Table 1. AHP importance scale (Saaty, 2008)

Definition	Level of Importance	Description
Equal importance	1	Criteria *i* and *j* are equally important.
Moderate importance	3	Criteria *i* is less important than Criteria *j*.
Important	5	Criteria *i* is more important than Criteria *j*.
Very important	7	Criteria *i* is much more important than Criteria *j*
Extremely important	9	Criteria *i* is definitely more important than Criteria *j*.
Intermediate value	2, 4, 6, 8	

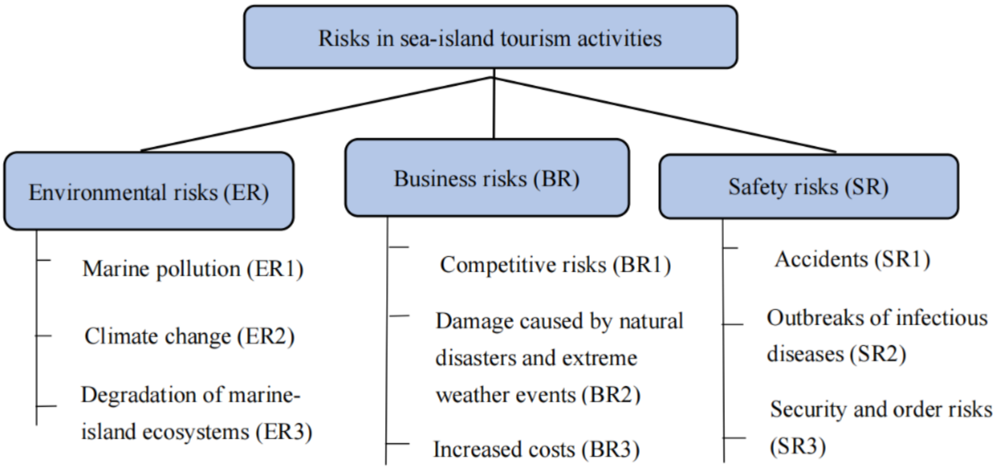

Figure 2. AHP model diagram of risks in tourism activities of Quang Ngai Province

The data was synthesized and processed. Then matrices were built to compare risk criteria, and calculations were conducted using the Excel software. The calculated value is only accepted when CR is less than or equal to 10% (0.1). Table 3 shows the Random Index (RI) values. With the Consistency Index (CI), CR is calculated as follows: CR=CI/RI. In addition, CI=(λ_{max}-n)/(n-1), where λ_{max} is the eigenvalue of the matrix, with λ_{max}= $\sum_{i=1}^{n} wi \times \sum_{j=1}^{n} aij$. The characteristics of the sample of experts participating in this study are shown in Table 4.

Table 2. Risk criteria in sea-island tourism activities in Quang Ngai Province

Level 1 Risk Criteria	Level 2 Risk Criteria	Explanation
Environmental risks (ER)	Marine pollution (ER1)	Waste and wastewater from tourism activities, the daily life of people and coastal businesses, and oil leaks from tourist boats, which pollute the coastal environment and seawater resources.
	Climate change (ER2)	The complex situation of climate change causes sea levels to rise; extreme weather events such as storms and floods can cause coastal erosion, affecting tourism projects as well as tourism activities.
	Degradation of marine-island ecosystems (ER3)	Overexploitation of marine resources without limits and construction and dredging activities can degrade marine ecosystems, affecting the biodiversity of marine-island ecosystems.
Business risks (BR)	Competitive risks (BR1)	Unhealthy competition, unstable service prices, and conflicts of interest among stakeholders in the tourism industry can reduce the attractiveness of tourist destinations and affect legitimate businesses.
	Damage caused by natural disasters and extreme weather events (BR2)	Natural disasters and extreme weather events can cause major damage to infrastructure and assets of businesses operating in the tourism sector, causing severe disruptions to business operations and thereby reducing business revenues.
	Increased costs (BR3)	Investing in climate change response activities and coping with extreme weather events can increase costs for tourism businesses.
Safety risks (SR)	Accidents (SR1)	Accidents at sea or other incidents can occur due to a lack of skills from tourists or due to the subjectivity of both tourists and tourism businesses. Or accidents can come from the negative impact of bad weather, endangering tourists.
	Outbreaks of infectious diseases (SR2)	Waterborne and insect-borne diseases or other dangerous infectious and epidemic diseases can affect the health of tourists.
	Security and order risks (SR3)	Theft, robbery, and fraud can occur in tourist areas, affecting the psychology, trust, and safety of tourists.

Table 3. RI parameter (Saaty, 1984)

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Table 4. Expert characteristics

Job/Position	Experience in the Field of Sea-island Tourism		
	5-10 years	11-15 years	16-20 years
Director	Two experts	Five experts	Two experts
Public administration officer in the tourism industry	Four experts	Three experts	

The overall weight of the risk criteria is the product of the group and internal weights. The group weight is the weight of the first-level risk criteria, and the internal weight is the weight of the second-level risk criteria. The results of calculating the overall weight of the risk criteria in sea-island tourism activities were used in the research when performing analysis and drawing the Pareto chart.

3.3 Pareto Principle

Pareto analysis can be conducted in two main steps. The first step is to identify the problem that needs to be solved, which can be risks, errors, defects, etc. Then each problem needs to be evaluated and scored one by one. The second step is to draw a Pareto chart, which helps to detect the prominent, key problems that need to be dealt with (Brooks, 2014). In this study, the first step was performed based on the AHP method. In the second step of Pareto analysis, a Pareto chart was drawn using Excel based on the results of the common weights found.

In the Pareto chart, the line representing the cumulative percentage of the criteria is the component that needs attention. From the vertical axis on the right, a straight line was drawn starting from the 80% position to intersect the cumulative percentage line. From this intersection point, a perpendicular line was then extended downward to the horizontal axis. It can be deduced that the problems on the left side of the line perpendicular to the horizontal axis can cause up to 80% of the consequences and need to be prioritized for resolution. Or in other words, it means that 80% of the consequences come from 20% of the causes (Abyad, 2020).

4. Results

4.1 Expert Characteristics

Typically, the sample size in qualitative research is small, ranging from 5 to 50 participants, because qualitative research methods and expert methods often involve gathering in-depth understanding of an event or phenomenon; journals do not want to rigidly quantify sample size in qualitative research (Dworkin, 2012). In this study, a purposive sampling method was used with 16 experts.

The expert panel consisted of 16 members, including seven public administration officers in the tourism industry and nine directors, each representing a different private enterprise operating in the tourism sector in Quang Ngai. These experts were selected because of their professional knowledge and high-level education. Five of them graduated from university, and the remaining 11 members graduated from postgraduate programs. In particular, one of the important factors was their experience in the tourism sector, especially in the aspect of sea-island tourism. Table 4 shows the characteristics of the experts consulted for this study.

4.2 Weight Results

After collecting the scoring data of the experts, each pairwise comparison matrix of each expert was processed separately. Then a comparison matrix was built, and the preliminary CR was calculated. Three scoring matrices with a CR above 0.1 were eliminated. The remaining 13 matrices were synthesized and processed according to the majority expert principle, from which a comparison matrix was built and the priority vectors were calculated. The priority vectors of the first-level and second-level risk criteria in tourism activities in Quang Ngai were calculated according to AHP, as shown in Table 5 to Table 8.

To ensure the consistency of expert judgments, CR was computed. The number of criteria is n = 3, and the maximum eigenvalue was found to be λ_{max}=3.0112. CI was calculated as: CI= $\frac{\lambda max-n}{n-1} = \frac{3.0112-3}{3-1}$ = 0.0056. Since CR= $\frac{CI}{RI} = \frac{0.0056}{0.58}$ = 0.0096, which is below 0.1, the comparison matrix is considered consistent and acceptable for use in the final analysis.

Table 5. Priority vectors of the first-level risk criteria

	ER	BR	SR	Priority Vector
ER	1	1/2	1/3	0.1638
BR	2	1	1/2	0.2973
SR	3	2	1	0.5390

Note: ER indicates the environmental risks, BR indicates the business risks, and SR indicates the safety risks.

Table 6. Priority vectors of the second-level risk criteria (ER)

	ER1	ER2	ER3	Priority Vector
ER1	1	1/5	1/2	0.1222
ER2	5	1	3	0.6479
ER3	2	1/3	1	0.2299

Note: ER1 indicates the marine pollution, ER2 indicates the climate change, and ER3 indicates the degradation of marine-island ecosystems.

To validate the consistency of the pairwise comparison matrix, CR was calculated. The number of criteria is n=3, and the maximum eigenvalue is λ_{max}=3.0054. CI was computed as: CI= $\frac{\lambda max\text{-}n}{n\text{-}1}$ = $\frac{3.0054\text{-}3}{3\text{-}1}$ = 0.0027. Given the RI value of 0.58 for n=3, then CR= $\frac{CI}{RI}$ =$\frac{0.0027}{0.58}$ = 0.0047, which is below 0.1. Therefore, the judgments are considered consistent and acceptable for analysis.

Table 7. Priority vectors of the second-level risk criteria (BR)

	BR1	BR2	BR3	Priority Vector
BR1	1	1/5	1/2	0.1179
BR2	5	1	4	0.6806
BR3	2	1/4	1	0.2014

Note: BR1 indicates the competitive risks, BR2 indicates the damage caused by natural disasters and extreme weather events, and BR3 indicates the increased costs.

The consistency of the expert judgments was assessed through CR. With n=3, the largest eigenvalue was calculated as λ_{max}=3.0383. CI= $\frac{\lambda max\text{-}n}{n\text{-}1}$ = $\frac{3.0383\text{-}3}{3\text{-}1}$ = 0.0191. Using the RI value of 0.58 for n=3, then CR= $\frac{CI}{RI}$ =$\frac{0.0191}{0.58}$ = 0.0330, which is below 0.1. Therefore, the consistency level is acceptable and the results are considered reliable.

Table 8. Priority vectors of the second-level risk criteria (SR)

	SR1	SR2	SR3	Priority Vector
SR1	1	2	7	0.6150
SR2	1/2	1	3	0.2924
SR3	1/7	1/3	1	0.0926

Note: SR1 indicates the accidents, SR2 indicates the outbreaks of infectious diseases, and SR3 indicates the security and order risks.

Table 9. Overall weight of risk criteria in tourism activities

Criteria	Global Weight	Local Weight	Overall Weight
Marine pollution (ER1)	0.1638	0.1222	0.0200
Climate change (ER2)	0.1638	0.6479	0.1061
Degradation of marine-island ecosystems (ER3)	0.1638	0.2299	0.0376
Competitive risks (BR1)	0.2973	0.1179	0.0351
Damage caused by natural disasters and extreme weather events (BR2)	0.2973	0.6806	0.2023
Increased costs (BR3)	0.2973	0.2014	0.0599
Accidents (SR1)	0.5390	0.6150	0.3315
Outbreaks of infectious diseases (SR2)	0.5390	0.2924	0.1576
Security and order risks (SR3)	0.5390	0.0926	0.0499

To verify the consistency of the pairwise comparisons, CR was calculated. The number of criteria is n=3, and the maximum eigenvalue was found to be λ_{max}=3.0038. CI was calculated as: CI= $\frac{\lambda max\text{-}n}{n\text{-}1}$ = $\frac{3.0038\text{-}3}{3\text{-}1}$ = 0.0019.

Based on the RI value of 0.58 for n=3, then $CR=\frac{CI}{RI}=\frac{0.0019}{0.58}=0.0032$, which is below 0.1. Therefore, the expert judgments are considered consistent and acceptable for further analysis.

From the above equations, it can be seen that there is consistency in decision-making. Therefore, the weights of the first-level (global weight) and the second-level (local weight) risk criteria and the overall weight were obtained, as shown in Table 9.

4.3 Analysis Results and Pareto Chart Drawing

From the calculation results of the overall weight of the risk criteria, the cumulative overall weight and corresponding percentage were calculated. Based on these results, a Pareto chart was drawn. The results of the cumulative overall weight and corresponding percentage are shown in Table 10.

Table 10. Pareto analysis results

Criteria	Overall Weight	Cumulative Overall Weight	Cumulative Overall Weight (%)
SR1	0.3315	0.3315	33.15
BR2	0.2023	0.5338	53.38
SR2	0.1576	0.6914	69.14
ER2	0.1061	0.7975	79.75
BR3	0.0599	0.8574	85.74
SR3	0.0499	0.9073	90.73
ER3	0.0376	0.9449	94.49
BR1	0.0351	0.9800	98.00
ER1	0.0200	1.0000	100.00

Figure 3 shows the overall weighting results of the risk criteria in tourism activities before performing the Pareto analysis. Figure 4 shows the results after the analysis.

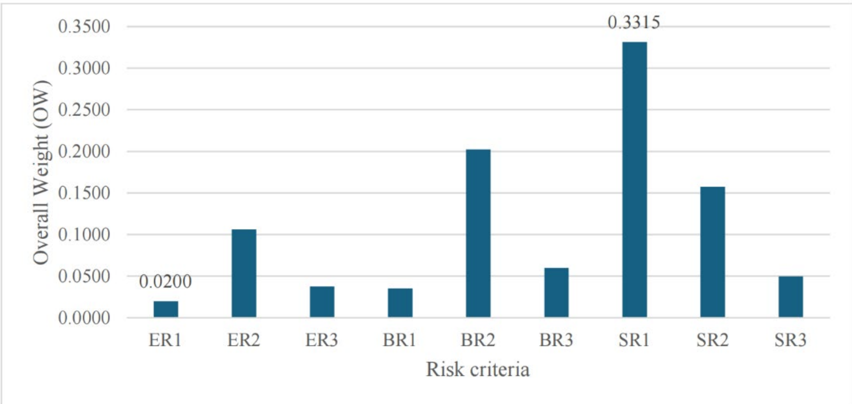

Figure 3. Overall weighted results of risk criteria in tourism activities

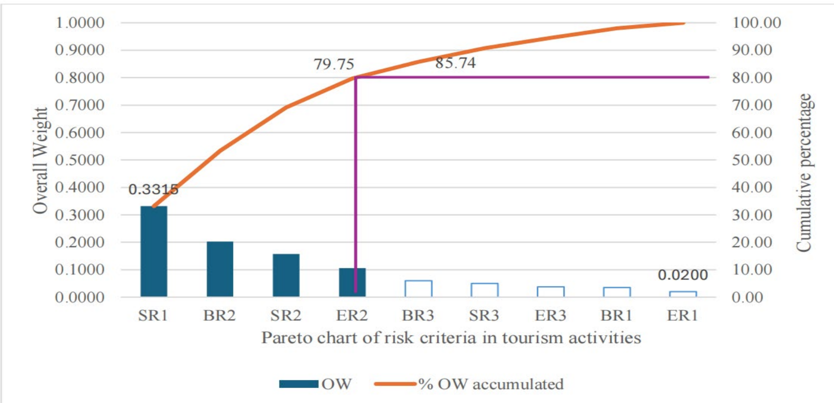

Figure 4. Pareto chart of risk criteria in tourism activities in Quang Ngai

The Pareto analysis results show that the top four important risk criteria need to be prioritized for handling among the total nine criteria in tourism activities of Quang Ngai Province. The list of these criteria is shown in Table 11.

Table 11. Top-priority risks to handle

No.	Symbol	Criteria	Overall Weight
1	SR1	Accidents	0.3315
2	BR2	Damage caused by natural disasters and extreme weather events	0.2023
3	SR2	Outbreaks of infectious diseases	0.1576
4	ER2	Climate change	0.1061

The results of Table 11 show that the most important risk criterion is accidents, while the criterion of damage due to natural disasters and extreme weather events is among the most important risks. Meanwhile, Kerber & Kramm (2022) highlighted the risk of environmental pollution from plastic waste dumping in tourism in Phu Quoc Island, Vietnam. Nguyen et al. (2022) emphasized the risk of epidemics and infectious diseases when studying tourism activities in Nha Trang, Vietnam. In addition, Hai & Thanh (2020) emphasized the impact of climate change risks when studying sea tourism activities in Sam Son, Vietnam. This shows that climate change is a common risk issue for sea-island tourism activities in Vietnam; however, in each locality, specific risks arise from its unique characteristics. For example, pollution is a prominent issue in Phu Quoc because this island attracts a large number of domestic and foreign tourists, while in Quang Ngai, accidents are the leading risk arising from existing infrastructure, equipment, and lax, unprofessional management.

5. Conclusions, Policy Implications, and Limitations

5.1 Conclusions

Sea-island tourism activities in Quang Ngai are facing various risks that negatively impact the natural environment, businesses, and tourists. This study aims to prioritize risks in sea-island tourism activities in Quang Ngai Province, Vietnam. To achieve this goal, the AHP method was used in combination with Pareto analysis. Through group discussions with experts with knowledge and experience in the field of tourism specializing in sea-island tourism, risk criteria in tourism activities were identified. Then the AHP method was used to determine the overall weight value. Pareto analysis was used to identify the most important risk groups. The research results show that the four most important risks that need to be prioritized include accidents, damage caused by natural disasters and extreme weather events, outbreaks of infectious diseases, and climate change, with overall weight values of 0.3315, 0.2023, 0.1576, and 0.1061, respectively. The remaining risks in the total of nine risks, although not in the top important group, still need attention from managers and administrators because each risk has a certain impact on the goals of the organization or tourism business. Those risks are summarized as marine pollution, degradation of marine-island ecosystems, competitive risks, increased costs, and security and order risks.

5.2 Policy Implications

From the research results, it is recommended that priority should be given to handling the top risk groups, including the risks of accidents, damages caused by natural disasters and extreme weather events, outbreaks of infectious diseases, and climate change, because they have a large impact on the overall risk profile.

- Risks of accidents: To limit accidents in island tourism activities, tourists need to pay attention to complying with safety signs and staying away from areas with warnings of danger. In Quang Ngai, a place often affected by extreme weather, business managers need to monitor the weather regularly, strengthen forecasting and warning work, avoid organizing tours during storms and intense heat, always equip tourists with necessary protective equipment, comply with all principles when operating tourist boats, and not overload passengers compared to regulations.
- Risks of damage caused by natural disasters and extreme weather events: This is a macro issue; to thoroughly resolve it requires the participation of many parties, especially state management agencies and planners. For businesses, it is necessary to proactively prevent and respond to natural disasters to minimize possible damage because Quang Ngai is located in the central region, which is always subject to many adverse weather phenomena such as storms and floods that occur frequently, quite often, all year round. At the same time, businesses need to implement many measures, including risk assessment, response plan development, green technology investment, and participation in natural disaster insurance. The important and extremely practical thing is that each business should take specific actions such as contributing to forest protection and afforestation, protecting upstream forests, and taking advantage of all possible resources of the business to contribute to fulfilling social responsibility in the fight against

climate change.

- Risks of outbreaks of infectious diseases: Tourists should be proactive in taking care of themselves every time they travel and need to comply with the regulations and recommendations of tour operators or managers when conducting field experience tourism. For businesses, it is necessary to ensure the best accommodation environment when organizing tours and always be ready to provide the best medical support for tourists, especially in conditions of epidemics or infectious diseases that are quite rampant. The state management agency for tourism has the responsibility to strictly monitor public health when an epidemic occurs and must always provide timely support to businesses when complicated health situations occur.
- Risks of climate change: This is a macro issue, requiring the participation of many parties, not only state management agencies and businesses but also each of us. A long-term and sustainable solution is to have a mindset of adapting to climate change through small but useful actions of each of us, such as changing to a green lifestyle, saving energy, using less polluting means of transport, reducing household waste, or choosing sustainable food, or more macro-level actions, such as developing renewable energy, using solar energy, wind energy, and other clean energy sources, or paying attention to waste management by minimizing, recycling, and reusing waste to reduce greenhouse gas emissions.

5.3 Limitations

This study was conducted with a small sample of 16 experts; future studies could be conducted with a larger sample. The study only considered the impact of risks by calculating the overall weights, without considering the frequency of risk occurrence. Therefore, future studies could add this aspect. The study did not delve into the interplay between other sectors involved in tourism operations. The Analytic Hierarchy Process (AHP) method could be deployed in combination with other methods in risk assessment, such as Decision Making Trial and Evaluation Laboratory (DEMATEL) and Failure Mode and Effects Analysis (FMEA), or Analytic Hierarchy Process (AHP) could be integrated with spatial analysis Geographic Information System (GIS).

Data Availability

The data used to support the research findings are available from the corresponding author upon request.

Conflicts of Interest

The author declares no conflict of interest.

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