RESILIENCE ENHANCEMENT OF TOURISM SUPPLY CHAIN AMID UNCERTAIN SITUATIONS: DEVELOPING COUNTRIES, A CASE IN POINT

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ABSTRACT

Derived from Supply Chain Management (SCM), Tourism Supply Chain (TSC) is the integration of tourism-related activities, and is more sensitive to an uncertain event like a natural disaster due to its high dependency on nature. Moreover, compared to developed countries, the TSC in developing countries like Pakistan is more susceptible to natural disasters and disruptions owing to the country's weak infrastructure. As a result, the tourism sector in developing countries faces serious threats because of their weak resistance to uncertain natural disasters. Therefore, this study aims to enhance the resilience of the TSC in developing countries by evaluating different threats in top tourism hotspots using the Fuzzy Analytical Hierarchy Process (FAHP). Then, based on the FAHP results, Fuzzy Quality Function Deployment (FQFD) is used to propose the best risk mitigation strategies to deal with those threats. Furthermore, the study also estimates the cost of implementing the top mitigation strategy in developing countries to check the practicality of the results. The results showed that planning and implementation of emergency response is the best strategy to deal with natural disasters in Pakistan. Similarly, real-time monitoring and forecasting ranked as the second-best strategy to enhance TSC resilience. The use of FAHP-based FQFD in the area of tourism and improving its resilience, especially from the lens of developing countries is the prime novelty of the study.

Keywords: Fuzzy AHP; Fuzzy QFD; mitigation strategies; tourism supply chain; resilience enhancement

1. Introduction

The management of multiple activities among different people across the supply chain is known as Supply Chain Management (SCM). SCM is not only a chain of business-to-business and one-to-one activities, but it is a network of multiple relationships and

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businesses (Lambert & Cooper, 2000). The Tourism Supply Chain (TSC) is much different since suppliers of tourism-related activities are more complex and independent (Lee & Fernando, 2015). It is the network of performing different activities like providing accommodation facilities and flights to tourists, helping them stay and helping them reach their destination safely. Tourism, like other supply chains, performs through business-to-business relationships, and therefore, SCM can be applied to deliver sustainable performance improvements by working to improve the operations of each supplier in the chain. TSC not only involves transport and accommodation but also integrates restaurants, waste disposal, infrastructure, and food production (Tapper & Font, 2004). Therefore, controlling and managing all these different activities is difficult, as they form a complex network that is susceptible to any change or disruptions occurring in the system.

Disruption in the TSC can be caused by disasters that could be either manmade or natural. Natural disasters include visible natural disasters like earthquakes or invisible ones like a pandemic. Manmade disasters can also be either visible, like a terrorist attack, or invisible, like global warming, which is directly caused by humans generating and releasing excess pollutants into the environment. Nevertheless, despite these disruptions and difficulties, tourism has become one of the most prominent sectors of many countries due to its major contribution to the economy. Therefore, developed countries are heavily dependent on this sector and try to improve it through coordination with other sectors. For example, the number of tourists per worker in France is about 24 which is greater than the number in Switzerland which is 12. Moreover, in France there are about 0.13 tourists per bed while there are 0.06 in Switzerland. Thus, France can generate more tourists for each bed and worker compared to Switzerland (Hadad et al., 2012).

Similarly, despite the disruptions, developing countries are also heavily reliant on the tourism sector. Historically, Cambodia experienced the brutalities of the Khmer Rouge genocide that occurred in the 1970s, including famine, and mass executions. However, in 2015, around 5 million foreign tourists visited Cambodia, which contributed about 3 billion US dollars to its economy. Likewise, Vietnam was badly exposed to war in the 1970s, yet, in 2017, the country hosted around 8 million foreign tourists, which contributed about 8.4 billion US dollars to their economy (Wongsurawat & Shrestha, 2018).

Nonetheless, despite heavy reliance on the tourism industry by both developed and developing countries, the tourism sector of developed countries is more resilient to disruption than developing countries. The reason for such resilience is their more durable and robust TSC when compared to the developing nations. For example, after the Boston Marathon bombing incident in 2013, the tourism industry of the United States recovered in a mere 2 weeks due to the quick response of emergency teams and the national disaster management plan set by the government (Shipway, 2018). However, the tourism industry of India, which contributes about 6% to the GDP, did not recover for a year after the Mumbai Taj Mahal hotel bombing in 2008 (Gunasekar et al., 2018). Similarly, the tourism industry of Pakistan, throughout its history has also suffered heavily from disasters. The tourism sector was majorly hit by earthquakes in 2005, which was followed by a surge in terrorist attacks from 2009 to 2014 (Arshad et al., 2018). Such events shattered the TSC of Pakistan and the tourism sector could not recover until late

2018, when it was unfortunately hit again by the global pandemic of 2019. Hence, there is a dire need to enhance TSC resilience in developing countries to reduce the ramifications of disruptions and disasters.

Therefore, the purpose of this study is twofold. First, the study aims to find the threat level of different manmade and natural disasters that could disrupt the TSC of developing countries like Pakistan. For this purpose, the FAHP was used to evaluate different kinds of threats in multiple tourism hotspots in Pakistan. The top three hotspots, namely Kalam, Naran, and Hunza were selected for the analysis. The decision to evaluate multiple hotspots was made in order to get a complete picture of TSC in Pakistan since a threat faced by one hotspot and the mitigation strategy to tackle it might not apply to another hotspot. Therefore, different threats, both manmade and natural, visible and non-visible were evaluated in all the hotspots.

Second, based on the various threats faced by the tourism industry, different mitigation strategies were evaluated through the Fuzzy Quality Function Deployment (FQFD) model. The methodology is best suited for this study, as the results obtained from FAHP are translated into the FQFD model. The different threats and their threat levels, which are obtained from FAHP are translated into WHATs and criteria weight in the FQFD model, respectively. The different mitigation strategies become HOWs in the model making a correlation between the various threats, their threat level, and the different mitigation strategies. This makes it possible to find the single best solution for enhancing the resilience of TSC in developing countries like Pakistan.

2. Literature review

The Supply Chain (SC) concept is characterized by a forward flow of goods in return for the backward flow of information and consists of seven key business processes: demand management, procurement, product development, customer relationship management, commercialization, manufacturing flow management, and demand management (Zhang, et al., 2009). The use of this concept in different fields has a long history. SCM was proposed for the first time by Houlihan (1985) and since then the concept has been widely used in almost every field, including the tourism industry. The concept of SCM in the field of tourism covers several fields such as the transport industry, hotel industry, and other entertainment activities. TSC comprises all suppliers and producers that are directly or indirectly related to tourists (Ghaderi et al., 2018). In the current competitive environment, the tourism industry has changed and restructured to a large extent. This competitive environment has made it very clear that the tourist industry needs to opt for different methods to enhance its competitive advantage. The tourism industry faces the challenge of increasing profits affecting customer service. Therefore, in recent years, the tourism sector has developed significantly in the world while greatly contributing to the economy (Jena & Jog, 2017).

Tourism is a vital pillar for every country, playing a crucial role in boosting the economy across both developing and developed regions. Therefore, countries make efforts to keep the tourism industry safe amid uncertain situations and ensure resilience in the tourism sector to tackle any sort of disruption. The United States mitigates the impact of disasters on the whole infrastructure of the country via flood insurance and damage prevention

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policies. Other measures that are used include removing homes altogether, infrastructure to combat earthquakes, engineering buildings, and creating building codes to avoid floods, hurricanes, and other natural disasters (Comerio, 2004). For the sake of mitigating natural disasters, Canada calls on its planners to secure social efficiency, economy, and environmental well-being. This means the need for planners to work closely with other industries has increased. The government also has the civil responsibility to ensure that it has the capability to provide essential services in case of an emergency. Canadian planners participate in training for emergencies, develop local licensing regulations and suitable insurance, and broaden the planning process involving affected parties (Newkirk, 2001). According to the literature, the number of people killed in disasters in developing countries is three to four times greater than that in developed countries (WHO, 1992). To mitigate disasters, developing countries focus on measures such as land management, controlling urbanization, controlling poverty, engineering devices, social regulations, and economic improvement (Wongsurawat & Shrestha, 2018). South India is highly critical of cyclone mitigation policies which rely mainly on a technical cure rather than address the socioeconomic and other political factors leading to natural disasters (El-Masri & Tipple, 2002). Likewise, nearly all developing countries lack proper planning and strategies for the mitigation of disruption to their TSC. The lack of literature to improve the resilience of TSC from the perspective of developing countries makes the problem even more severe. This study aims to fill the gap and is novel by contributing to the enhancement of TSC in developing nations like Pakistan through the use of FAHP-based FQFD.

The current research applies FAHP, an extension of the AHP, a well-known Multi-Criteria Decision Making (MCDM) method, originally developed by Saaty (Saaty & Vargas, 1979). In 1983, a study combined the AHP method with the fuzzy set theory, thus enabling a hybrid formulation of the methodology in the form of an extension, i.e., FAHP (Laarhoven & Pedrycz, 1983). The reason for incorporating the FAHP is that it addresses the limitations of the conventional AHP which include the fact that the AHP mainly relies on pairwise comparisons where the decision makers struggle with providing the exact numerical values. Alternatively, the fuzzy set theory mitigates this struggle by allowing the value ranges through the implementation of the fuzzy numbers. In a general scenario, a hierarchy is developed from a more general criterion to a particular criterion on the bottom level (Chan et al., 2008). The FAHP was applied in one study to evaluate the service performance of foreign travels from the perspective of the host travel agency who had hotels, restaurants, souvenir stores, and bus companies as their suppliers (Lin et al., 2009). In Turkey, the FAHP was used to select the best global supplier in the pharmaceutical industry. Four main criteria and thirteen sub-criteria were selected for the problem of supplier identification. Quality, services, technical, and price were the main criteria in this research (Tas, 2012). In another study, the FAHP was used in Global Supply Chain Management (GSCM) to analyze the risks in GSCM and prioritize them based on ranking. They considered the set of parameters that influence the decision of individuals in selecting healthcare services such as treatment, response time, health service satisfaction, and costs. After their assessment, they found that selecting services is seriously affected by the quality of the healthcare system and by the customer's income. The low-income families hardly ever manage to access private healthcare services. They prefer charity-run or government hospitals (Rahman & Qureshi, 2008).

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Fuzzy Quality Function Deployment (FQFD) originated in 1972 in Japan. The methodology has a long history and many applications in various domains. It is a useful tool for decision-making, continuous product improvement, and quality planning. QFD is not enough to interpret fuzzy language and convert it into technical terms. Therefore, fuzzy logic can be integrated with it to generate an objective and more precise method for implementation (Lee et al., 2015). QFD comprises the following four matrices: operative instruction matrix, product characteristics deployment matrix, process, quality control matrix, and customer requirement planning matrix (Bottani & Rizzi, 2006). India has used FQFD in the healthcare industry to trace customers' needs that are very uncertain because they vary from person to person (Mangla et al., 2015). Many enterprises have used the methodology for product design and selection processes. Due to highly competitive markets, the product life cycle was reduced, which forced the enterprises to rush the new product into the market. Therefore, it became an issue of serious concern which was addressed by FQFD (Liu, 2011). In another study, the methodology was applied to improve logistics processes and ultimately customer satisfaction. Logistics and SCM reveal that customer service has become an issue for many companies. Therefore, by enhancing logistics performance levels, companies increase customer satisfaction which also leads to a gain in market share (Bottani & Rizzi, 2006). Similarly, in Pakistan FQFD was used to improve the market niche of electric vehicles and make them more competitive with the combustion vehicles available on the market (Babar & Ali, 2021).

The novelty this study offers is the application of hybrid methodologies like FAHP-based FQFD in the area of TSC, especially from the perspective of developing nations. These methodologies are applied because a gap has been identified in the tourism sector literature, even though different disasters have been identified and ranked but never translated into resilience improvement and practical implementations. Hence, this study attempts to fill the gap in practical implementation by applying these methodologies to enhance TSC resilience from the developing countries' perspective.

3. Data collection and methodology

A FAHP-based FQFD methodology was used in the study. For this hybrid methodology, two different sets of data were collected. The first set of primary data was collected to evaluate and rank different disasters, which were analyzed using the FAHP and then translated into weights for FQFD. The second set of primary data was collected to evaluate different mitigation strategies, which were directly used in the FQFD methodology. The data collection and the analysis process of both methodologies are given below.

3.1. Fuzzy Analytic Hierarchy Process

The collection of primary data for the FAHP was initiated by identifying the top tourism hotspots in Pakistan. Kalam, Naran, and Hunza were identified as the top three tourism hotspots in the country (TCKP, 2020a). Next, the major threats to the tourism industry in Pakistan were identified from different sources and are given in Table 1. The threats were set as criteria (A_n) in the FAHP analysis, which were compared to each other in all three tourism hotspots, to find the top threat in each area.

Table 1
Major threats to Pakistan TSC

Major Threats (A_n)	**Sources**
A_1. Landslides	(TCKP, 2020b)
A_2. Pandemic	(NDMA, 2018)
A_3. Climate change	(World Bank, 2019)
A_4. Terrorism	(TCKP, 2020b)
A_5. Earthquake	(NDMA, 2018)

Based on the criteria (A_n) and the top three hotspots, a questionnaire was developed and circulated online to collect data from experts in the field of tourism and disaster management. A total of 55 responses were collected from different experts whose demographic details are shown in Figure 1.

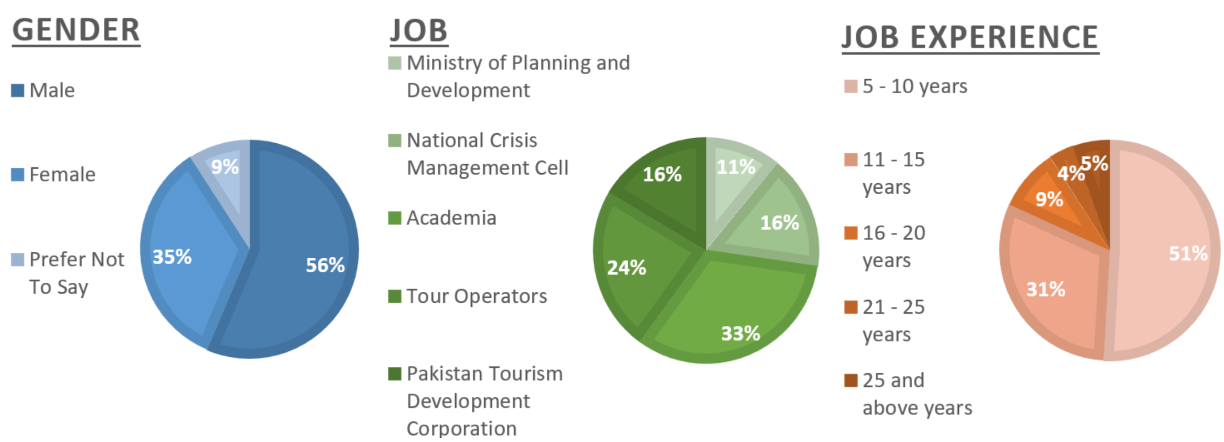

Figure 1 Demographics of experts

Thereafter, the FAHP methodology was used to rate the importance of risk against other risks in the context of the three tourism hotspots and to formulate weights to use in the FQFD. The step-wise FAHP is as follows:

Step 1: A pairwise matrix was constructed using the fuzzy scale shown in Table 2.

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Table 2
Linguistic variables and their corresponding values

Linguistic Variables	Triangular Fuzzy Numbers
Very Slightly Important (VSI)	(0,0,1)
Slightly Important (SI)	(0,1,3)
Moderately Important (MI)	(1,3,5)
Highly Important (HI)	(3,5,7)
Very Highly Important (VHI)	(5,7,9)

Source: Babar & Ali (2022)

Step 2: From the data obtained through the questionnaire, a pair-wise comparison matrix was created using Equation 1.

$$A_i = [a_{ij}];\ \mathrm{i,j} = 1,2,3,4,5 \ldots \ldots \ldots \mathrm{n} \quad (1)$$

The entries of the comparison matrices follow three simple rules as shown below:

$$A_{ij} > 0, a_{ij} = \frac{1}{a_{ij}}; a_{jj} = a_{ii} = 1$$

Step 3: Next, the computation of fuzzy weights was done. The geometric mean is used to calculate the fuzzy weights by applying Equation 2 and Equation 3.

$$r_i = [(l_1 \otimes l_2 \otimes l_3 \otimes \ldots \ldots \otimes l_i)^{1/i},\ [(m_1 \otimes m_2 \otimes m_3 \otimes \ldots \ldots \otimes m_i)^{1/i}, [(u_1 \oplus u_2 \oplus u_3 \oplus \ldots \ldots \oplus u_i)^{1/i}] \quad (2)$$

$$w_i = r_i \otimes \left(r_1 \oplus r_2 \oplus\ \ldots r_j\right)^{-1} \quad (3)$$

Step 4: In this step, the fuzzy weights were defuzzified *(CW_i)* using the center of area method as shown in Equation 4.

$$CW_i = w_i = \frac{l+m+u}{3} \quad (4)$$

3.2. Fuzzy Quality Function Deployment (FQFD)

To collect primary data for the FQFD, a questionnaire was circulated, using the house of quality also called the FQFD model. The five threats or criteria *(A_n)* of the FAHP become the WHATs in the FQFD model. Furthermore, eight mitigation strategies were also identified from an extensive literature review which became the HOWs in the FQFD model. From the experts mentioned in Figure 1, three experts were identified and selected based on their knowledge of the FQFD model. The questionnaire was sent to these three experts for each of the three tourism hotspots, namely Kalam, Hunza, and Naran. They were asked to fill in the WHATs vs HOWs and HOWs vs HOWs matrix in the house of

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quality to the best of their knowledge using the provided fuzzy scale. The house of quality collected from one of the respondents is shown in Figure 2, unveiling the WHATs and HOWs, the top three different tourism regions Kalam, Hunza, Naran, and the three-point fuzzy Likert scale for WHAT vs HOW and four-point Likert scale for HOW vs HOW matrix.

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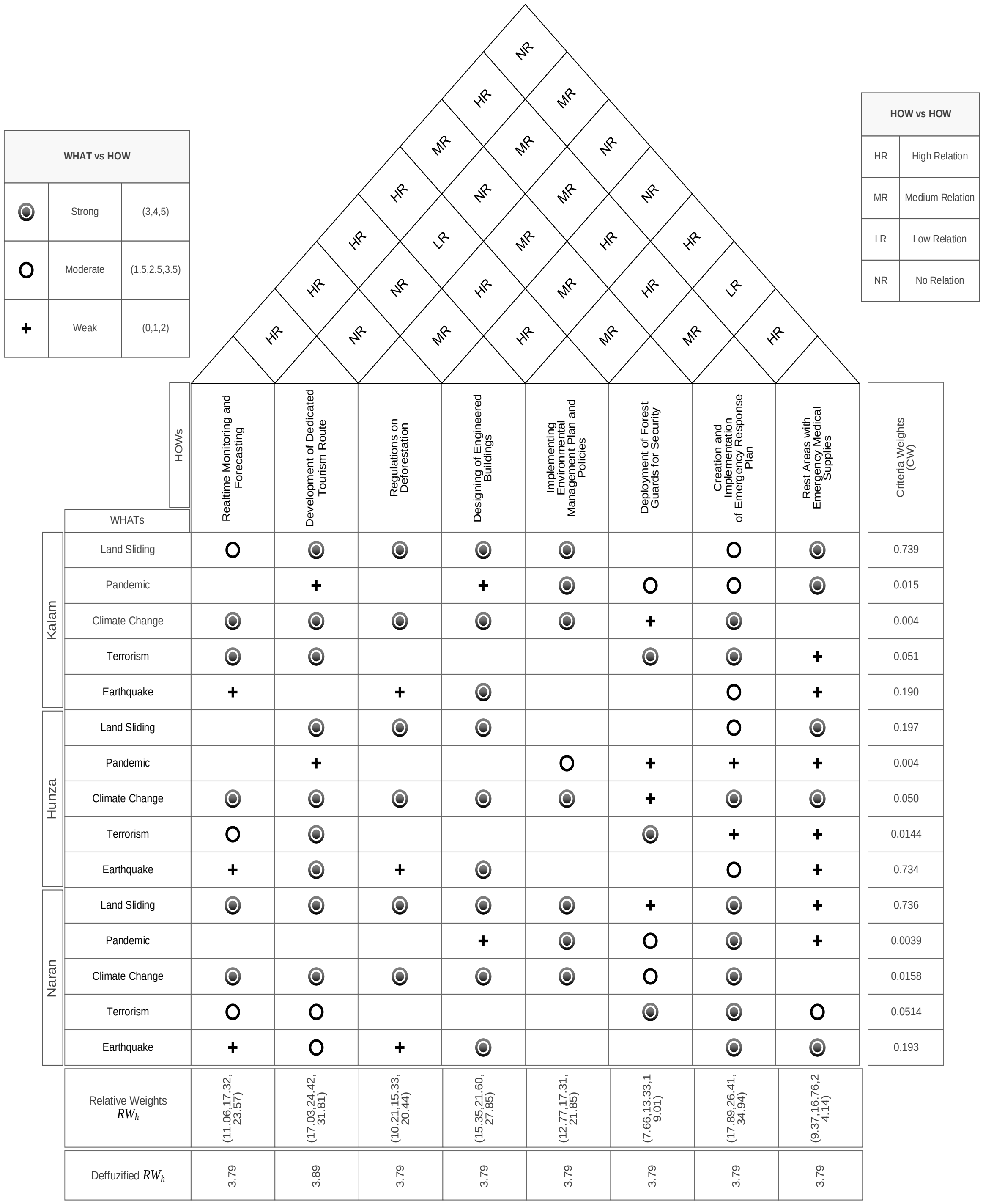

Figure 2 House of quality from an expert respondent

Figure 2 gives a glimpse of the FQFD model and data collected from one of the three different expert respondents. In the model, eight mitigation strategies are mentioned horizontally as HOWs while the risks are shown vertically as WHATs. The respondents were asked to rate the degree of correlation between these HOWs and WHATs based on fuzzy numbers as shown in the upper left box of Figure 2. In the upper right box, a linguistic scale is mentioned to rate the correlation between HOWs and HOWs. The triangular shape above the HOWs is known as the roof of the house of quality, which reveals the rate of linguistic scale in terms of correlation between HOWs vs HOWs according to the respondent's expert judgment. In the far-right column, the criteria weights (CW_i) values are mentioned which were obtained from the last step of the FAHP. Relative weight (RW_h) is given in the second last row, while the defuzzified relative weight is given in the bottom row of the house of quality.

The step-wise method of computing FQFD is as follows:

Step 1: Collect the primary data from the group of experts in the FQFD model and transform the linguistic variables and symbols of WHATs vs HOWs and HOWs vs HOWs matrix into their triangular fuzzy numbers (FN_{wh}) and (FN_{hk}) respectively, as per the provided scale.

Step 2: Take the values of Criteria Weights (CW_i) obtained from Equation 4 of FAHP and multiply them with each of the triangular fuzzy values (FN_{wh}) in the aligned rows of the WHAT vs HOW matrix to get the degree of correlation between WHATs and HOWs. Equation 5 gives the mathematical formula for this.

$$CR_{wh} = CW_i \times FN_{wh} \tag{5}$$

where, i=w, w represents the WHATs, while h represents the HOWs of the FQFD model. Here the CR represents the Correlation Rating or a weighted value between a threat (WHAT) and a strategy (HOW).

Step 3: Next, the relative weight (RW_h) of each HOW is calculated through summation of all the values CR_{wh}in each column of HOW using Equation 6.

$$RW_h = \sum_h CR_{wh} \tag{6}$$

Step 4: Defuzzification of the relative weight (RW_i) is done through Equation 7.

$$R_j = Defuzzified\ RW_h = \frac{1}{3} \times (x_1 + x_2 + x_3) \tag{7}$$

Where, h=j

Step 5: Take the summation of the triangular fuzzy values (FN_{hk}) of each HOW from the HOWs vs HOWs matrix, also called the roof of the house of quality, using Equation 8 and then defuzzify it through Equation 9, respectively.

$$H_h = \sum_{k=1}^{nh} FN_{hk} \tag{8}$$

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$$T_j = Defuzzified\ H_h = \frac{1}{3} \times (y_1 + y_2 + y_3) \quad (9)$$

Where, h represents HOW, and k represents the subsequent HOWs.
$k = 1,2,3 \ldots nh$ and $h=j$

Step 6: Find the final value of each mitigation strategy (M_j) also called HOWs by incorporating the values of the HOWs vs HOWs matrix into the WHATs vs HOWs matrix using Equation 10 given below.

$$M_j = R_j + (T_j \times R_j) \quad (10)$$

Step 7: Now, normalize the values of (M_j) using Equation 11 and rank the mitigation strategies based on normalized values.

$$Normalized\ M_j = \frac{M_j}{\sum_{j=1}^{n} M_j} \quad (11)$$

4. Results and discussion

Multi-Criteria Decision-Making (MCDM) methodology like the FAHP was the first methodology used to weight the disasters in the top three tourism hotspots in developing countries like Pakistan. This was done to check the individual major threat in each of the three tourism hotspots. The results of the FAHP are given in Table 3, where each of the five major threats was set as criteria *(A_n)* in the FAHP analysis.

Table 3
FAHP analysis results

Major Threats (A_n)	**Tourism Hotspots**					
	KALAM		**HUNZA**		**NARAN**	
	FAHP (w_i)	**Ranking**	**FAHP (w_i)**	**Ranking**	**FAHP (w_i)**	**Ranking**
Landslides	0.739	1	0.197	2	0.736	1
Pandemic	0.015	4	0.004	5	0.003	5
Climate Change	0.004	5	0.050	3	0.016	4
Terrorism	0.051	3	0.014	4	0.051	3
Earthquake	0.190	2	0.734	1	0.193	2

From the results, it can be seen, that in Kalam and Naran, the number one threat to tourism is landslides, whereas in Hunza, the major threat is from earthquakes. Additionally, by taking the average FAHP values of each threat from the three spots and ranking them, the resultant rank gives the overall threat ranking for the whole TSC in Pakistan. Here, it is necessary to mention that the FAHP weights were derived using a consistent set of criteria, linguistic scales, and expert evaluations across all the three hotspots. This ensured that the weights were comparable across the locations thus

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allowing an overall average ranking for Pakistan's tourism sector to be computed without the need for additional equivalence transformations. The results of the average ranking are shown in Table 4.

Table 4
Overall ranking of major threats to TSC

Major Threats *(A_n)*	**Average FAHP**	**Ranking**
Landslides	0.557	1
Pandemic	0.007	5
Climate Change	0.023	4
Terrorism	0.039	3
Earthquake	0.372	2

From Table 4, the results become more clear as it reveals that in fact, the major threat to the overall TSC of Pakistan is landslides, followed by earthquakes and terrorism. Climate change and the subsequent pandemic pose the least amount of threat to the TSC. Once the FAHP results were obtained, the weight of the threats *(w_i)*, as given in Table 3, were incorporated in the FQFD model as Criteria Weights *(CW_i)*, as mentioned in Step 2 of section 3.2. The major threats *(A_n)* in the FAHP become the WHATs in the FQFD model, as shown in Figure 2.

The steps in section 3.2 were followed to analyze the responses collected from the three experts of the FQFD model. The significance of each of the eight mitigation strategies (M_j) in improving the resilience of TSC was calculated individually from each of the three experts' responses using Equation 10. Then, from the three responses (s = 1, 2, 3,), the mean of each mitigation strategy (M_j), also called HOWs, was calculated and normalized through Equation 11. The HOWs were then ranked in descending order based on the normalized values. The detailed results of the FQFD model are given in Table 5.

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Table 5
Results of FQFD analysis

HOWs / s^{th} Response	REAL-TIME MONITORING AND FORECASTING	DEVELOPMENT OF DEDICATED TOURISM ROUTES	REGULATIONS ON DEFORESTATION	DESIGNING OF ENGINEERED BUILDINGS	IMPLEMENTING ENVIRONMENT MANAGEMENT PLAN AND POLICIES	DEPLOYMENT OF FOREST GUARDS FOR SECURITY	CREATION AND IMPLEMENTATION OF EMERGENCY RESPONSE PLAN	REST AREAS WITH EMERGENCY MEDICAL SUPPLIES
Response M_{j1}	19.2596	12.4963	17.1241	15.3910	19.3976	0.4822	17.1527	8.7179
Response M_{j2}	14.6953	3.9841	5.3747	8.4693	0.1009	0.0000	10.6654	3.7367
Response M_{j3}	16.8761	18.5144	16.1759	24.5517	17.0195	2.5106	23.4820	12.3325
Mean	16.9437	11.6649	12.8916	16.1373	12.1727	0.9976	17.1000	8.2624
Normalized	0.176	0.121	0.134	0.168	0.127	0.010	0.178	0.086
Final Ranking	2	6	4	3	5	8	1	7

According to the FQFD results, planning of emergency response and its implementation is the best and top-ranked strategy to mitigate the risks to the TSC in Pakistan. This is in line with the realities of Pakistan, and other developing countries since disasters, whether natural or manmade can happen, even in the most modern and developed countries of the world. However, many lives that could be saved are lost due to the lack of a quick emergency response plan. This is one of the reasons many tourists are reluctant to visit developing countries as they lack safety measures to mitigate the risks of disasters. The hesitation is even greater after the latest disaster event, which affects the whole TSC. Therefore, a proper response plan is crucial for a quick and timely reaction to any disaster and not allowing it to persist.

Subsequently, real-time monitoring and forecasting are ranked as the second-best strategy to alleviate the risks of disasters. An early warning and precise forecasting could give sufficient information to the tourists to either avoid a certain destination or evacuate to safety on time. Similarly, designing engineered buildings that are disaster-resistant can also significantly reduce the risks to the TSC in developing countries. A prime example of such an infrastructure can be found in Japan, where buildings are earthquake-proof, and can easily withstand quakes of 6 to 7 magnitudes (Wada et al., 2000). Therefore, proper engineering of the level of depth, height, width, design, and construction material could make the tourism infrastructure more reliable and resistant to sudden damages caused by the impact of the disaster. Likewise, other strategies could also be implemented to reduce the risks of disasters and ultimately improve the resilience of TSC in developing countries.

Based on the emergency response plan of the United Kingdom (Goverment of UK, 2022), a sample of emergency response teams was designed to assess the monetary implications of creating and implementing an emergency response plan in developing countries. Table 6 gives the cost estimations of such an emergency response plan in Pakistan. All the cost estimation values have been converted from Pakistani rupee into United States dollars at the rate of 170 PKR to 1 US$.

Table 6
Total cost of emergency response plan

Object	**Units**	**Per unit cost**	**Total cost**
Helicopter	2	US$ 11,000,000 (Business Jet Traveller, 2014)	US$ 22,000,000
Ambulance	20	US$ 8,250 (OLX, 2022)	US$ 165,000
Fire brigade	5	US$ 1,000,000 (Fire Rescue 1, 2019)	US$ 5,000,000
Worker	50	US$ 1800 per annum (Glassdoor, 2014)	US$ 90,000
Heavy machinery	5	US$ 15,900 (CAT, 2022)	US$ 79,500
Tents	100	US$ 50 (OLX, 2022)	US$ 5,000
Medical Tents	10	US$ 150 (Alibaba, 2022)	US$ 1,500
Stretcher	100	US$ 40 (OLX, 2022)	US$ 4,000
Drone	10	US$ 250 (OLX, 2022)	US$ 2,500
Total cost of an emergency response plan			US$ 27,347,500

From Table 6, the total cost of an emergency response plan is estimated to be around US$ 27 million. The cost incurred by the TSC of Pakistan in just one natural disaster that occurred in 2005 was estimated at around US$ 2.3 billion (World Bank, 2005). In comparison, the cost of an emergency response plan is very feasible for the government of Pakistan to pursue as it is only a one-time investment and the maintenance costs are never greater than 10% of the whole plan. Therefore, as far as the damages to the TSC by natural and manmade disasters are concerned, investment in an emergency response plan is the most feasible and practical strategy to enhance the resilience of the TSC in developing countries.

5. Conclusion

In the modern world, tourism plays a major role in the development of the economy, in both developed and developing countries. Therefore, any type of disruption in the Tourism Supply Chain (TSC) is seen as a major issue and a grave concern. However, compared to developed countries, developing countries like Pakistan are much more

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vulnerable to disasters. Hence, these countries are struggling to protect their TSC from various disruptions caused by natural and manmade disasters.

Therefore, this study aimed to overcome the problem by enhancing the resilience of the TSC of developing nations and making it more robust against various threats and disruptions. For this purpose, MCDM methodologies like the FAHP based on FQFD were used. First, the FAHP was used to rank the different threats in the top three tourism hotspots in Pakistan, namely Kalam, Naran, and Hunza. Thereafter, the results of the FAHP were integrated into FQFD to assess and find the best mitigation strategy to deal with those threats. The analysis resulted in the identification of landslides as the top threat to the TSC in Pakistan, whereas the creation and implementation of an emergency response plan were identified as the best strategy to enhance the resilience of the TSC. Based on the results of this study, governments of developing countries are encouraged to create an emergency response plan based on their location and tourism hotspots. The cost of the creation of such a plan is very minute compared to the cost that would be incurred by the occurrence of a disaster. Moreover, having a sound emergency response plan will also put the safety concerns of potential tourists at ease and therefore encourage them to travel to the country's tourist destinations, which will further improve the TSC and the country's economy. A further study can be pursued in the area of tourism by taking other specific natural or manmade disasters and the best method to recover from such events in developing countries.

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