International Information and Engineering Technology Association
Advancing the World of Information and Engineering

International Journal of Sustainable Development and Planning
Vol. 19, No. 4, April, 2024, pp. 1337-1346
Journal homepage: http://iieta.org/journals/ijsdp

An Application of the Stakeholder Theory and Proactive-Reactive Disaster Management Principles to Study Climate Trends, Disaster Impacts, and Strategies for the Resilient Tourism Industry in Pokhara, Nepal

Nishanta Sharma[1*], Vilas Nitivattananon[1], Takuji W. Tsusaka[1], Rishikesh Pandey[2]

[1] Department of Development and Sustainability, School of Environment, Resources and Development, Asian Institute of Technology, Pathum Thani 12120, Thailand
[2] School of Development and Social Engineering, Pokhara University, Pokhara 33700, Nepal

Corresponding Author Email: st121664@ait.ac.th

https://doi.org/10.18280/ijsdp.190411

Received: 15 November 2023
Revised: 25 March 2024
Accepted: 7 April 2024
Available online: 28 April 2024

Keywords:
disaster management, hospitality and tourism, proactive reactive disaster management, stakeholder theory

ABSTRACT

This research investigates climate trends, disaster impacts, and the tourism and hospitality industry in Pokhara, Nepal by employing the stakeholder theory and proactive-reactive disaster management principles. A mixed-methods approach assessed geospatial climate trends, past disaster impacts, and future risks. Quantitative data collected from 150 hospitality enterprises via a structured questionnaire and qualitative data from key informants were analyzed using trend tests, multinomial and probit regressions, and thematic analysis. The results indicate climatic disasters as a major threat to the industry, impacting local economies and the revenue of enterprises. Managerial awareness of sustainable practices and enterprise size influence disaster experiences and preparedness. The findings underscore the roles of stakeholder perspectives, green technologies, education, and enterprise size in enhancing disaster preparedness and long-term resilience. Further research should strive to translate sustainability awareness into actionable disaster preparedness recommendations for stakeholders.

1. INTRODUCTION

Tourism encompasses diverse travel experiences, while hospitality focuses on guest satisfaction and relationships [1, 2]. Fluctuations in tourism affect demand for hospitality, especially in vulnerable areas. Research on disaster management and stakeholder collaboration is crucial to ensure the industry's sustainability and mitigate the psychological impact of disasters on local communities [3-5].

To ensure long-term resilience in the face of climate and other environmental changes, tourism and hospitality sectors need disaster preparedness strategies considering stakeholder perspectives and incorporating both proactive and reactive measures. This collaboration between internal stakeholders (hospitality profile and managers' profile) and external stakeholders (government, businesses) aims to achieve a coordinated response for disaster preparedness and long-term resilience. This research focuses on four research questions:

(1) What are the magnitude and trends of changes in key weather elements such as temperature and rainfall?

(2) What are the disaster trends impacting the hospitality and tourism industry?

(3) What factors influence the anticipated concern for future disasters among hotels and restaurants?

(4) What deficiencies exist in current disaster preparedness strategies?

The IPCC (Intergovernmental Panel on Climate Change) report [6] confirms that human activity has intensified climate extremes such as temperature fluctuations, droughts, and erratic precipitation. These weather extremes result in economic losses to tourism-dependent economies due to the reduced number of inbound tourists [7]. The economic risk in a tourism-dependent economy elevates as visitors typically avoid disaster-affected areas [8]. For example, Hurricane Irma caused an estimated USD 22 million in direct losses and up to USD 19,120 per day in indirect losses to Airbnb properties in Collier County, Florida [9]. The Hualien Area in Taiwan suffered substantial economic setbacks in the hotel industry due to the adverse effects of typhoons and floods witnessed on almost every occasion [10].

Proactive, equitable, and resilient policies are needed to alleviate vulnerabilities exacerbated by disasters [11]. Developing countries are particularly vulnerable due to geographic location, substandard housing and infrastructure, inadequate early warning mechanisms, and limited resources for relief operation [12]. For instance, landslides and floods in Vietnam disrupt access to tourist destinations. Siltation in Phewa Lake, Nepal reduces its aesthetic appeal [13, 14].

Tourism in Pokhara underwent several notable events, namely, Ekai Kawaguchi's visit in 1889, the first ascent of Mt. Annapurna I in 1950, the Hippie era and opening of commercial trekking tourism in 1966, the opening of the restricted area of upper Mustang trek in 1992, and Visit Pokhara Year 2007, collectively contributing to the boost in tourism. Today, Pokhara's economy heavily depends on its tourism and hospitality sector, with international arrivals increasing by 196% from 2001 to 2014 [15]. With 5,304 hotels and restaurants in Pokhara, the hospitality sector employs 19,489 individuals and ranks second highest in providing employment opportunities after wholesale and retail business [16]. Tourists' average length of stay (LOS) is nine days, with Chinese tourists, female tourists, and younger tourists having higher LOS than their counterparts [17].

2. THEORETICAL BACKGROUND

This study combines the stakeholder theory with proactive and reactive disaster management principles [18, 19]. The stakeholder theory emphasizes managing relationships beyond internal decisions, which is crucial for resilience of the tourism industry. Proactive disaster management aligns with a value maximization paradigm in Disaster Risk Reduction (DRR), while reactive approaches focus on post-disaster responses. Integrating the stakeholder theory with proactive-reactive disaster management forms a robust foundation for studying climate change, historical disasters, and the influence of stakeholder actions on tourism development and disaster management strategies [20]. Public and private stakeholders must collaborate to manage disasters effectively and co-create potential disaster mitigation strategies, paving the way for long-term partnerships that benefit the tourism sector [21, 22].

Understanding the detailed concepts of sustainable tourism (ST) provides the basis for proactive-reactive disaster management actions among stakeholders. A study highlighted the proactive aspect, linking sustainable development awareness to ethical values and practices in tourism [23]. Increased knowledge in ST management correlates with higher awareness of natural hazards, supporting proactive disaster management in Kaikoura, New Zealand [24]. Stakeholder education in disaster management plays a dual role, fostering proactive understanding and a reactive response. A study emphasized the proactive role of education in increasing awareness and mitigating risks [25]. Another study indicated that education enhances reactive preparedness, with degree holders outperforming non-degree holders in responding to challenges [26]. Stakeholders with expertise in sustainable consumption and production (SC&P) display a proactive approach to disaster management by incorporating green technologies into tourism strategies, addressing current environmental concerns, and promoting long-term sustainability [27]. Although barriers hinder the adoption of sustainable practices, addressing these obstacles allows stakeholders to implement proactive measures that reduce strain on ecosystems and optimize resource utilization, emphasizing the significance of awareness creation in disaster preparedness [28]. Previous research highlights that enterprises' age, type, and size are significant factors in crisis planning and disaster management [29], arguing that proactive planning is over-reactive. Some proactive approaches include advocacy for robust economic capital, comprehensive multi-hazard insurance coverage, and strategic budget allocation for disaster management exercises [30].

3. MATERIALS AND METHODS

This study used a mixed methods approach to address the research questions [31]. The quantitative instrument collected data from 150 enterprises, while the qualitative instrument gathered insights from internal stakeholders (managers of hotels and restaurants) and external stakeholders (local government members and private sector associations) on climate change impacts and disaster preparedness in the tourism and hospitality industry.

Pokhara, Nepal was selected as the study site (Figure 1). It is in the south of the Central Himalayas' Annapurna Range, experiencing climate change such as rising temperature and snow cover changes [32]. Recent research shows an observable asymmetric temperature trend on the southern slopes of the central Himalayas in Nepal from 1976 to 2015, where maximum temperature has increased annually by 0.045℃, surpassing minimum temperature elevation +0.009℃ (y−1), resulting in a significant rise in the diurnal temperature range by +0.034℃ per year [33]. In 2012, a major rock-slope collapse from the Annapurna Range triggered a catastrophic flood in Pokhara, causing widespread devastation [34]. Despite having nearly 60% of well-educated residents, the local community lacked awareness of disaster management plans and policies, and perceived disasters as acts of God beyond human control [3, 35]. The 2015 earthquake exposed weaknesses in Pokhara's disaster management, highlighting the need for improvements, especially considering the area's susceptibility to landslides [36, 37].

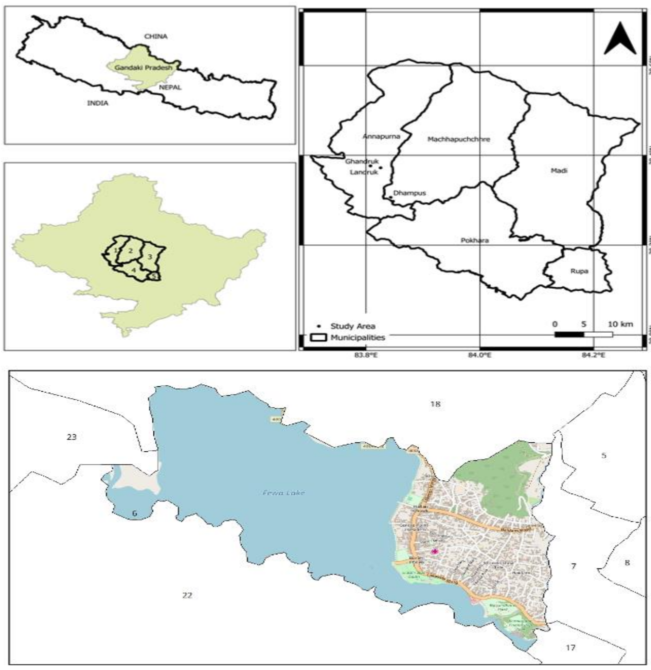

Figure 1. Location of Pokhara, Nepal
Source: Pokhara Metropolitan City Office (2023)

For the quantitative instrument, data from the previous study [16] show that Pokhara has 5,304 hotels and restaurants. Considering the population ($N = 5,304$) and aiming for an 8% margin of errors ($e = 0.08$), we applied the formula $n = N/(1+Ne^2)$ [38], suggesting a minimum sample size of 152. The final sample size was 150 enterprises. Purposive sampling facilitated the targeted recruitment of qualified tourism professionals from hotels and restaurants by ensuring expertise and experience alignment with research objectives [39]. We first identified all hotels and restaurants actively operating during the COVID-19 lockdown on the northwest shore of Phewa Lake. Referrals were used to identify subsequent enterprises within their immediate social circles or geographical proximity, extending from the northwest to the southeast shore of Phewa Lake. The data collection started from the northwest coast and progressed toward the southeast until the target sample size was met.

For the qualitative instrument, the key informants included representatives of the government and the association of private businesses that support tourism (PBST), consisting of ten informants in total. Four individuals were ward-level elected government representatives coded as G101, G102, G103, and G104, while the six individuals were nominated by ward government members, represent associations of different businesses crucial for tourism, who are coded as S101, S102, S103, S104, S105, and S106.

The structured questionnaire for the survey included business attributes such as enterprise type, investment, year of establishment, enterprise manager type, enterprise manager education, and awareness level. The questionnaire addressed past experiences with disasters, their impacts on businesses, and concerns about specific hazards in Pokhara. On the other hand, open-ended discussions with the key informants using the unstructured checklist helped receive firsthand accounts of observation of climate change, past disasters, and future disaster preparedness. The use of structured and unstructured data together helps predict stakeholder behavior, as unstructured data provide expert opinions, while structured data provide more accurate measurements [40].

In addition, this study examined the climate profile of the Lakeside, Pokhara, utilizing data from the Pokhara Airport Weather Station 0804 (28.2° latitude, 83.9° longitude, 827 meters above sea level), the Department of Hydrology and Meteorology for the 22-year period 1 January 2000, to 31 December 2021. Rainfall and temperature data were cross-validated with regional sources. Kendall's tau assessed associations between temporal and weather variables (year and temperature; year and rainfall), revealing temporal weather patterns [41]. Sen's slope estimator quantified trend magnitude, with positive values indicating increasing trends, negative values indicating decreasing trends, and zero suggesting no trend [42]. The trend analysis was performed using XLStat.

Multinomial logistic regression was employed to analyze categorical data on past disaster impacts on hotels and restaurants as in Eq. (1). The dependent variable (yi) represented categorical outcomes, with $y_i = 1$ (No impact) as the base category [43].

$$\begin{aligned} log\frac{\Pr\,(y_i = 2)}{\Pr\,(y_i = 1)} &= b_0 + \beta_1 Enterprise\ type \\ &+ \beta_2 Enterprise\ investment\ size \\ &+ \beta_3 Enterprise\ establishment\ (yrs) \\ &+ \beta_4 ManagerType + \beta_5 Manager\ Education\ level \\ &+ \beta_6 Manager\ ST\ Awareness \\ &+ \beta_7 Manager\ SCP\ Awareness \end{aligned} \quad (1)$$

where, Pr ($y_i = 1$) is the probability of enterprise *i* being in the base category; Pr ($y_i = 2$) is the probability of being in the second category (Lost income); and Pr ($y_i = 3$) is the probability of being in the third category (Asset damage).

Probit regression in Eq. (2) assessed factors influencing the anticipated future disaster concern in hotels and restaurants, coded as 0 for lower concern and 1 for higher concern [44]. Marginal effects in probit indicate the average change in the probability of having higher concern ($Y_{ki} = 1$) for a one-unit increase in an independent variable.

$$\begin{aligned} P(Y_{ki} = 1) &= \emptyset\ (\beta_0 + \beta_1 Enterprise\ type \\ &+ \beta_2 Enterprise\ investment\ size \\ &+ \beta_3 Enterprise\ establishment\ (yrs) \\ &+ \beta_4 ManagerType + \beta_5 Manager\ Education\ level \\ &+ \beta_6 Manager\ ST\ Awareness \\ &+ \beta_7 Manager\ SCP\ Awareness) \end{aligned} \quad (2)$$

where, $P(Y_{ki} = 1)$ is the probability of enterprise *i* having a higher concern over disaster k, where k = 1-6 refers to earthquake, flash flood, landslide, temperature rise, windstorm, and river flood, respectively.

Principal component analysis and the varimax orthogonal factor rotation method for disaster impact and anticipated future disaster with Kaiser normalization were utilized for factor extraction. The Kaiser-Meyer-Olkin (KMO) test assessed the sampling adequacy, the determinant of the correlation matrix evaluated multicollinearity among the variables, and Cronbach's alpha indicated the internal consistency of the indicators [45].

The qualitative data used thematic analysis to validate the quantitative findings on climate change patterns and historical calamity occurrences and identify deficiencies in current disaster preparedness strategies [46]. The qualitative analysis began by immersing the authors in the data through audio recordings. We then coded and grouped related ideas into themes. The thematic analysis methodically organized the qualitative data into themes and sub-themes, integrating contributing factors and relevant stakeholder quotes, with triangulation occurring in the discussion stage to support the overall exploration.

4. RESULTS

Table 1 shows that the majority (69%) of the survey respondents were hotels (69.3%). The median established year was 2016, and a median investment was USD 75,469. Operations were overseen more frequently by executive employees (57%), while 83 of the respondents had university degrees or higher. Notably, 73% of the respondents acknowledged ST principles, while 76% were aware of SC&P practices.

Table 1. Enterprises profile (*n* = 150)

S. N.	Profile Variable		Median	%
1	Enterprise type (1 if hotel)	0. Restaurant		30.7
		1. Hotel		69.3
2	Enterprise Investment (USD)		75,469	
3	Enterprise Establishment (year)		2016	
4	Manager (1 = Owner)	0. Executive Employee		57.3
		1. Owner		42.7
5	Manager Education (1 = Undergraduate and above)	0. School Level		17.4
		1. Undergraduate		82.5
6	Manager Awareness of ST (1 = Yes)	0. No		26.8
		1. Yes		73.2
7	Manager Awareness of SC&P (1 = Yes)	0. No		24.3
		1. Yes		75.7

Source: Survey data from hotel and restaurant enterprises, Pokhara, Nepal (2021)

Table 2 shows the KMO measure (0.703) indicating adequate sampling for factor analysis [47]. Bartlett's test (p = 0.000) confirmed the same [45]. Both components explained substantial variance (2.677 and 1.599 for the first and second components, respectively) and captured a significant portion together (61% cumulative variance). At the same time, Cronbach's Alpha values (0.602 and 0.580) suggest moderate reliability, potentially implying limited variables [48]. The Average Variance Extracted (AVE) values (0.538 and 0.560) indicated reasonable convergent validity [49]. Finally, Composite Reliability (CR) values (0.823 and 0.792) demonstrated good internal consistency [50].

Table 2. Factor loading and data validation

Variables	Component	
	1	2
Concern: Landslide	0.801	
Concern: Flashflood	0.753	
Concern: River flood	0.717	
Concern: Earthquake	0.656	
Concern: Windstorm		0.793
Disaster Impact		0.741
Temperature Rise		0.708
Determinant Score	0.155	
KMO	0.703	
Bartlett's Test of Sphericity	p = 0.000	
Initial Eigenvalue (> 1)	2.677	1.599
% of Variance Explained (61.08%)	38.24	22.84
Cronbach's Alpha (Reliability)	0.602	0.580
AVE	0.538	0.560
CR	0.823	0.792

Source: Survey data from hotel and restaurant enterprises, Pokhara, Nepal (2021)

4.1 Climate trends

Table 3 summarizes the data from the Pokhara Airport Weather Station, showing the climate trend with annual rainfall ranging between 2967 mm (2005) and 5454 mm (2020). The lowest average rainfall month was December (186 mm), while the highest was July (20710 mm). The mean annual rainfall during this period was 3857 mm. The rainfall trend was not statistically significant (p = 0.414). The maximum yearly temperature ranged from 26.4°C (2000) to 28.1°C (2009). December had the lowest monthly maximum (21.2°C) while June had the highest (31.2°C). The mean annual maximum temperature during this period was 27.3°C. The Sen's slope (0.017) suggests a slightly increasing trend (p = 0.085). The minimum yearly temperature ranged from 14.7°C (2000) to 16.7°C (2016). January had the lowest monthly minimum (7.3°C) while July had the highest (22.5°C). The mean annual minimum temperature during this period was 16.0°C. Sen's slope (0.025) and Kendall's tau (0.342) indicate a significant positive trend.

Figures 2 and 3 show a significant rise in the minimum and maximum air temperature since 2000 to 2020 by 0.6°C and 0.4°C, respectively, with year-to-year variations. Figure 4 illustrates yearly fluctuations in precipitation over the same period. These results are validated by previous climate trend analysis of data from upper tropical weather stations of Pokhara situated 300 to 1000 meters in elevation, including the Pokhara Airport Station, where average annual maximum and minimum temperature increased by 0.082°C and 0.080°C per year, respectively, and fluctuations in annual rainfall [51].

Table 3. Temporal trend analysis

Test (n = 22 yrs)	Rainfall (mm)	Max. Air Temp. (°C)	Min Air Temp. (°C)
Minimum year	2966.8 (2005) 2984.4 (2006)	26.4 (2000)	14.7 (2000)
Maximum year	5454.3 (2020)	28.1 (2009)	16.7 (2016)
Minimum month	186.4 (Dec.)	21.2 (Dec)	7.3 (Jan)
Maximum month	20709.9 (July)	31.2 (June)	22.5 (July)
Mean	3857.069	27.328	15.952
Std. deviation	725.404	0.378	0.499
Kendall's tau	-0.126	0.264	0.342
P-value	0.414	**0.085***	**0.026****
Sen's slope	-41.117	0.017	0.025

Source: Pokhara Airport Station 0804, Department of hydrology and meteorology (2021)

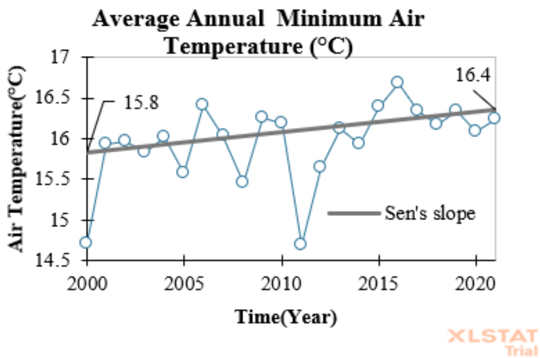

Figure 2. Sens slope of minimum air temperature

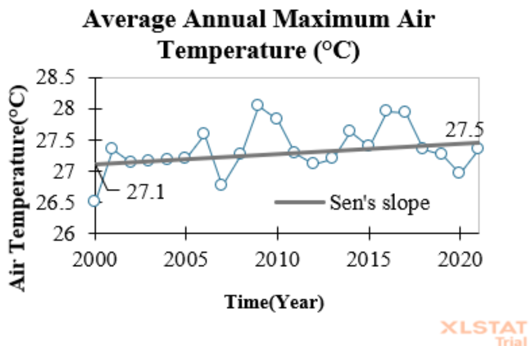

Figure 3. Maximum air temperature

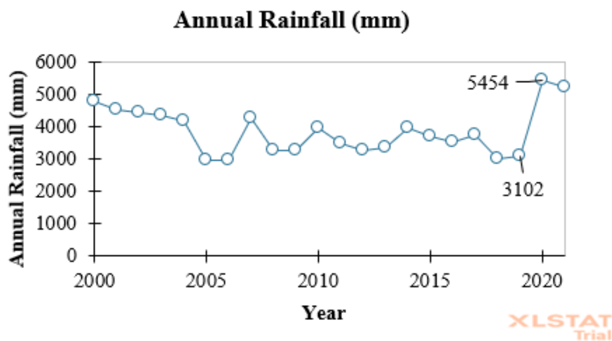

Figure 4. Annual rainfall (mm)

Source: Figures 2-4: Department of Hydrology and Meteorology, Pokhara airport station 0804, (2021), Kendall's tau and Sens slope analysis using XLStat

Table 4 corroborates the observed temperature rise through a thematic analysis of the key informant interviews. The three local government representatives reported noticeable shifts in Pokhara's weather patterns, including delayed winter onset (traditionally starting in Bhadra, now in Asoj/Karti) and irregular rainfall (G102, G104). These changes, attributed to broader climate change, were echoed by G101, highlighting the diminishing snow levels and consequent loss of Pokhara's winter scenery appeal. These altered climatic conditions will likely impact tourist preferences and expectations, potentially affecting the tourism experience.

Table 4. Observed changes in climate

Theme	Sub-theme	Climate Change Phenomena	Quotes
Changing Weather Patterns	Shifting Seasonality	Delayed winter seasons, temperature fluctuations, Irregular rainfall patterns, Reduced Winter Days	G102, G104
Aesthetic impact	Loss of Traditional Appeal	Diminishing snow levels and waning attraction of Annapurna Himalayan range winter scenery.	G101

Source: Authors' interviews with key informants (2021)

4.2 Disaster and events

According to the survey data, the hotel and restaurant enterprises observed landslide as the most common disaster from 2010 to 2021 (2017, 2018, 2019, 2021), followed by flash floods (2010, 2021), earthquake (2015), windstorm (2018), and river floods (2021). The temperature rise appears to be a recent phenomenon experienced two consecutive years, 2020 and 2021. A quote from Respondent S105 validates the occurrence of 11 disasters experienced by internal stakeholders. The thematic analysis of the quotes' mention of "always some kinds of disaster exist" corresponds to the diverse range of climate and disaster-related events listed in Table 4. This convergence between the informants' perspectives and the documented disasters strengthens the argument that Pokhara's tourism enterprises are vulnerable to climate-related disruptions.

Table 5 shows the informants' experiences with several disasters in the study area. Past disasters reduced tourist arrivals and caused financial losses for hospitality businesses (S102, S106, and G102). Disasters and climate change negatively affected local agriculture, raising the reliance on imported food and operational costs for hotels and restaurants (S102 and G102). Landslide, flood, and infrastructural damage caused by disasters negatively impacted tourist perceptions of the area (S103). The vulnerability theme highlighted the challenges of operating in hazardous zones, where limited land options and emotional attachments to ancestral property increased risks (S101 and G103). Additionally, negligence and lack of expert guidance regarding relocation and mitigation strategies exacerbated vulnerability (G103).

Descriptive analysis shows that the disaster did not impact most hotel and restaurant enterprises. In contrast, 29.3% of the enterprises experienced lost income due to disasters, with 11.6% experiencing property or asset damage.

Table 6 shows multinomial regression results, indicating that enterprises (hotels and restaurants) whose Person in Charge of Enterprise Operation (PICEO; indicated as Manager in table) is aware of SC&P practices were 2.25 times more likely to experience reduced income compared to those with PICEO (indicated as Manager in table) unaware of SC&P.

Table 5. Key informants' perspectives on disaster impacts

Sub-Theme	Contributing Factors	Quotes
Theme 1: Negative Impacts		
Sub theme1: Economic Loss	Decreased tourist arrivals and income.	S102, S106, G102
Sub theme2: Impact on Agriculture	Decreased local agriculture production resulted in increased operating costs with dependency on food imports.	S102, G102
Sub theme3: Landslides & Flooding	Disruption of travel routes, damage to infrastructure, and negative impact on tourist perception.	S103
Theme 2: Vulnerability		
Sub theme1: Property Emotions and Negligence	Lack of alternative land ownership attachment to ancestral property despite risks, Failure to relocate from high-risk areas; insufficient knowledge of mitigation strategies.	S101, G103

Source: Authors' interviews with key informants (2021)

Table 6. Disaster impacts on enterprises

	Profile Variable	Coeff.	*p*-value
Base Category = No Impact			
Lost Income	Enterprise Type (1 if hotel)	-0.264	0.568
	Enterprise Investment (USD)	0.245	0.336
	Enterprise Establishment (year)	0.001	0.652
	Manager (1=Owner)	0.527	0.207
	Manager Education (1=Undergraduate and above)	0.214	0.464
	Manager Awareness of ST (1=Yes)	-0.389	0.674
	Manager Awareness of SC&P(1=Yes)	2.251	0.032**
	Constant	-6.642	0.401
Asset Damage	Enterprise Type (1 if hotel)	-0.290	0.644
	Enterprise Investment (USD)	-0.375	0.296
	Enterprise Establishment (year)	0.002	0.76
	Manager (1=Owner)	-0.115	0.845
	Manager Education (1=Undergraduate and above)	-0.631	0.09
	Manager Awareness of ST (1=Yes)	1.720	0.305
	Manager Awareness of SC&P(1=Yes)	0.964	0.57
	Constant	-6.274	0.648
Dependent: Disaster Impact; *n*=139; AIC: 259.99			

Source: Authors' Survey with Hotels and Restaurants (2021)

4.3 Future concern

The survey data show that hotel and restaurant enterprises in Pokhara were most concerned about earthquake (53.4%), followed by river flood (18.3%) and landslide (12.9%).

Table 7 presents the results of probit regression analysis of factors influencing concerns for future disasters from internal stakeholders' perspectives. A USD 1 increase in investment size was associated with a 0.83% increase in the probability of having higher concern with flash flood. The result suggests that hotel and restaurant enterprises with larger investments are more concerned about the future occurrence of flash floods. PICEO (indicated as Manager in table) having undergraduate education compared to school-level education was associated with a 1.9% decrease in the probability of having higher concern with earthquake. This suggests that enterprise operators with higher education are less worried about the future occurrence of earthquakes. ST awareness was associated with a 26.1% increase in the probability of expressing higher concern about windstorms. The result suggests that PICEO (indicated as Manager in table) being aware of ST is more worried about future windstorms.

Table 7. Determinants of disaster concern

Concern for Earthquake (see Table 1 for variable names)	**Coeff.**	**Marginal Effects on Pr (y = 1)**	***p*-value**
1	-0.469	-0.172	0.414
2	0.020	0.007	0.063*
3	0.001	0.0005	0.877
4	-0.487	-0.179	0.306
5	-0.052	-0.019	0.033**
6	1.249	0.459	0.723
7	-1.006	-0.370	0.051
Constant	-1.977		0.124
Dependent Variable: Earthquake Concern (0 if lower concern; 1 if higher concern); n = 140; Wald χ^2 statistic = 11.9, (8), p-value = 0.15; AIC: 196.2			
Concern for flash flood			
1	-0.921	-0.187	0.633
2	0.040	0.008	0.003**
3	0.001	0.000	0.820
4	-0.207	-0.042	0.700
5	-0.326	-0.066	0.493
6	1.093	0.221	0.087
7	-0.461	-0.093	0.149
Constant	-2.734		0.535
Dependent Variable: Flash flood Concern (0 if lower concern; 1 if higher concern); n = 132; Wald χ^2 statistic = 56.9.9, (8), p-value = 0.00; AIC: 113.69			
Concern for landslide			
1	0.116	0.024	0.317
2	0.102	0.021	0.734
3	0.000	0.000	0.557
4	-0.077	-0.016	0.756
5	0.046	0.009	0.787
6	0.606	0.128	0.810
7	-0.058	-0.012	0.413
Constant	-2.694		0.938
Dependent Variable: Concern Landslide (0 if lower concern; 1 if higher concern); n = 132; Wald χ^2 statistic = 62.1, (8), p-value = 0.00; AIC: 117.63			
Concern for extreme temperature			
1	-0.403	-0.088	0.699
2	-0.146	-0.032	0.182
3	0.0009	0.0002	0.392
4	0.154	0.034	0.730
5	-0.036	-0.008	0.583
6	0.763	0.168	0.841
7	-1.097	-0.241	0.302
Constant	-2.139		0.135
Dependent Variable: Concern Extreme Temperature (0 if lower concern; 1 if higher concern); n = 134; Wald χ^2 statistic = 59.6, (8), p- value = 0.00; AIC: 123.19			
Concern for windstorm			
1	65.77	2.454	0.995
2	-0.129	-0.004	0.945
3	-0.031	-0.001	0.738
4	0.225	0.008	0.353
5	-0.893	-0.033	0.726
6	6.992	0.260	0.046**
7	-1.611	-0.060	0.999
Constant	-9.316		0.999
Dependent Variable: Concern Windstorm (0 if lower concern; 1 if higher concern); n = 131; Wald χ^2 statistic = 5.0, (7), p-value = 0.66; AIC: 33.93			
Concern for river flood			
1	-0.265	-0.057	0.980
2	-0.084	-0.018	0.421
3	0.001	0.000	0.642
4	-0.240	-0.051	0.722
5	0.023	0.005	0.414
6	4.805	1.036	0.906
7	4.831	1.042	0.989
Constant	-12.49		0.989
Dependent Variable: Concern River Flood (0 if lower concern; 1 if higher concern); n = 134; Wald χ^2 statistic = 1.7, (7), p-value = 0.98; AIC: 118.77			
Statistical significance: *** at 1%; ** at 5%; * at 10%			

4.4 Disaster preparedness

Table 8 presents preparedness, challenges, and responsibility concerning disaster preparedness. The absence of planned resilience was evident against natural disasters at the local government level, with a reliance on the Red Cross preparedness plan over government initiatives. Following the 2015 earthquake, PBST stakeholders reported increased awareness but remained unclear about preparedness. Another critical aspect was the "Ineffective federal and local government support" during disasters, with local-level governance requiring external assistance. Anthropogenic factors, particularly infrastructural development, contribute to vulnerability to disasters, as new roads and tracks increase the risk of flood and landslide. The "Responsibilities" theme underscores the tourism industry's need to address disaster and climate risks, emphasizing the alignment of tourism policy with disaster management for preparedness. The role of "External actors" is acknowledged, emphasizing the collaborative approach required, including external assistance from NGOs and international organizations for effective disaster preparedness and response.

Table 8. Key informants' perspectives on disaster preparedness, challenges, and responsibility

Theme	**Sub-Theme**	**Contributing Factors**	**Informants**
Preparedness	Ineffective government support and concrete plans	No planned resilience against natural disasters.	S101, S102
		No government preparedness, only Red Cross disaster preparedness plan available.	S106
		Raised awareness, but implementation unclear.	S102
Challenges	Infrastructure	New roads and tracks raise flood and landslide risk.	S104
Responsibility	Role of external actors	The stakeholders of the tourism industry must confront the situation by collaborating with NGO's.	S101, G101
		We need to align tourism policy with disaster management.	G104

Source: Authors' interviews with key informants (2021)

5. DISCUSSIONS

The paper addressed the four research questions of climate change trends, disaster impacts, future concerns, and disaster preparedness deficiency in the tourism and hospitality industry, Pokhara, Nepal. This study aligns with existing research, demonstrating the negative impacts of climate change, especially rising temperature, on the tourism industry. Observed temperature increases, exceeding the global average, highlight the area's vulnerability. Consistent with the literature [6], these changes include delayed winters, unpredictable rainfall, and reduced snowfall, negatively impacting the Annapurna range's attractiveness and tourist experiences [32, 33, 52]. Raising awareness of climate change is crucial to fostering responsibilities and safeguarding tourist attractions and related livelihoods [53]. Thus, the rising temperature makes tourism-dependent areas less attractive and impacts the hospitality and tourism industry.

This study aligns with existing literature by demonstrating the interconnectedness of tourism, local agriculture, and hospitality, highlighting their collective vulnerability to disasters and subsequent economic disruptions [54]. It emphasizes the need to manage the complex relationships between these sectors and foster disaster resilience [55, 56]. Furthermore, the findings highlight the significant impact of natural disasters on tourists' perceptions and travel, potentially hindering economic revitalization efforts [13, 14, 56, 57]. Additionally, limited land options and constrained resources exacerbate the vulnerability of the tourism and hospitality business in developing countries [12].

Our analysis suggests a negative correlation between PICEO (Manager) knowledge of SC&P and enterprise income. This seemingly counterintuitive finding justifies the trade-off between short-term costs and long-term benefits of SC&P adoption. While sustainable practices like carbon capture demonstrably mitigate climate threats [27, 58], implementing them can pose financial challenges, especially for recently established businesses (Note: median year was 2016) in areas like Pokhara, which have faced disruptions from pandemic lockdowns and earthquakes since 2010. Findings highlight that disaster resilience of the hospitality industry needs financial support for SC&P adoption, particularly within tourism-dependent areas [28].

Results show a sudden short-term rainfall spike by 75.8% from 2019 to 2020. Hotel and restaurant enterprises with larger investments tend to have higher concerns about flash flood as investors in capital-intensive tourism sectors are more exposed to risks and tend to take steps to mitigate them [59]. Enterprises with managers with undergraduate and above degrees positively influence risk perceptions, preparedness, and mitigation efforts, including developing contingency plans and insurance measures [25, 26, 60]. Enterprises with managers aware of ST pose an increased concern for natural hazards by fostering deeper understanding of natural hazards, including windstorms, and contribute to stakeholders' heightened sense of responsibility and preparedness [23, 61, 62]. Recognizing the varying concerns for different natural hazards based on investment size, education level, and sustainability encourages further dialogue on knowledge sharing between tourism and hospitality enterprises and disciplines working on different hazards and risks at various spatial scales [63]. The absence of concrete disaster preparedness plans in Nepal's tourism industry reflects the ongoing need for action, as observed in the wake of the 2015 earthquake, thereby necessitating collaboration with NGOs and international organizations to overcome resource limitations and enhance community-based disaster preparedness [21, 37, 64, 65].

This study underscores the theoretical implication of the importance of diverse stakeholder perspectives [66]. The study contributes by exploring the proactive potential of green technologies in disaster resilience of the hospitality sector [27, 28], which underscores the potential for such technologies to strengthen hospitality enterprises against disasters and align with the Sustainable Development Goals (SDGs). Additionally, the study further contributes to proactive disaster management by exploring the proactive potential of enterprise managers with higher education and awareness of ST to lay the foundation for sustainable practices and ethical values, and develop contingency plans for the hospitality sector. These implications emphasize proactive collaboration and knowledge sharing among stakeholders to enhance disaster preparedness and build long-term resilience in the tourism sector.

6. CONCLUSION

This paper examined the complex relationship between climate change, past disasters, future concerns, and disaster preparedness the tourism and hospitality industry in Pokhara by utilizing the stakeholder theory and proactive-reactive disaster management principles. Climate data trend analysis exposed an alarming increase in minimum and maximum air temperature, which seems to have shifted weather patterns and impacted the area's traditional appeal. The increased frequency and intensity of disasters necessitate a shift from reactive to proactive disaster management. Enterprises must implement risk reduction strategies ex-ante, rather than reacting ex-post. Investment in sustainable practices by enterprises increases awareness of future disaster risks. This connection suggests that promoting ST can positively impact disaster preparedness. Managerial education and higher initial investment in enterprises are linked to higher concern for future disasters, implying that training on financial resources can bolster disaster preparedness. Current disaster preparedness strategies need proper planning and rely heavily on external aid. Aligning them with tourism development policies can create a more robust and holistic approach to disaster resilience.

As the study focused on Pokhara, the generalizability of the findings to other regions or industries is limited. Furthermore, while the study identified areas for improvement in disaster plans, it only captured views of the limited hospitality sector. Therefore, further research should consider deeper analysis of climate trends focusing on translating sustainability awareness into disaster preparedness, providing actionable recommendations for stakeholders.

ACKNOWLEDGMENTS

The authors thank Roger Levermore for comments and guidance on the early version of the manuscript. The authors also thank the respondents who kindly provided their views and answers during our data collection. This work was supported by the Asian Institute of Technology Scholarship and University Grant Commission, Nepal Ph.D. fellowship (Grant No.: PhD-78/79-H&S-01).

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