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Impact of Climate Change on the Level of Insurance Risk: A Perceptual Study in Nepal

Kishor Hakuduwal
Bhaktapur Multiple Campus, Tribhuvan University, Nepal
khakuduwal@gmail.com

Gopal Man Pradhan*
Bhaktapur Multiple Campus, Tribhuvan University, Nepal
pradhangopalman@gmail.com

Sumitra Khwalapala
Independent Researcher
sumitrakhwalapala@gmail.com

Corresponding Author*
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Abstract

Background: Climate change is now emerging as a major concern to the insurance sector that are influencing their underwriting, pricing, and risk management policies, procedures, and systems. Natural calamities like floods, landslides, and earthquakes are aggravated by weather variations. Such incidents do not only cause massive economic losses, but also heighten the susceptibility of people and communities creating more workload on the insurance industry for effective risk management. The study aims to analyse the climate change and the level of insurance risk in Nepal.

Methods: The research design used in the study is a descriptive and explanatory, where primary data was gathered using an online survey on 424 non-life-insured respondents of Kathmandu Valley with a 5-point Likert scale. It is analyzed using descriptive statistics, correlation, and multiple regression. The reliability and multicollinearity tests are used to assess the strength of the measurements.

Results: The results indicate that extreme weather frequency and severity, geographical exposure, and internal risk management practices are strong predictors of financial vulnerabilities and claim volumes. However, existing climate rules are not yet directly affecting

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perceived risk levels, suggesting they may play a role due to poor enforcement, limited scope of control, and an imbalance between regulatory requirements and the actual climatic threat posed to insured individuals.

Conclusion: The frequency and severity of extreme weather events, as the factors that significantly increase insurance risk in Nepal, raise the volumes of claims and financial liability. The geographical exposure also increases losses with the place-specific risks. Climate regulations do not have a direct impact, although the predominant element is physical risks.

Novelty: This is a unique study to capture the under-researched context of Nepal. It employs a perceptual prism to examine the influence of climatic factors and geographical exposure in creating insurance risk in a developing economy.

Keywords: Climate change, Insurance risk, Extreme weather events, Geographical exposure

Introduction

Climate change has become one of the most important issues to the global economies by affecting various sectors, which include agriculture, infrastructure, and financial systems. The insurance industries are the most prominent among them as they are among the key players in the transfer and management of risks based on the extreme weather events and other forms of impact witnessed by climate. Emerging risks of insurers due to the growing number and severity of extreme weather events like floods, droughts, and storms, have affected the way policy is underwritten, risk management and pricing strategies (Hamzeh et al., 2024). As a result of these changes, insurers across the world have since re-assessed their strategies to make sure that they can operate sustainably due to emerging risks.

Climate change issue on insurance rates is another crucial area of concern during entering into insurance agreement to cover the worth of business property and assets. The rise in extreme weather, frequency, and intensity have contributed to a rise in claims, leading to higher premiums and a decline of coverage in most areas (Hamzeh et al., 2024). This trend introduces serious challenges to insurers as well as insured individuals especially in the low-income countries, such as Nepal, where the aspect of affordability is a major issue. Kousky et al. (2024) claimed that long-term planning was necessary to achieve market stability and affordability, but the study did not require the particular factors that contribute to price choice in the situation of developing economies. In Nepal, where insurance access itself is low, it is important to determine how climate risks affect the price in order to come up with policies that are affordable and sustainable.

The geographical and socio-economic peculiarities of Nepal make it an interesting country to study the correlation between climate change and insurance risk. Natural calamities like floods, landslides, and earthquakes are common in the country and are aggravated by weather variations. Such incidents do not only cause massive economic losses, but also heighten the susceptibility of people and communities creating more workload on the insurance industry to formulate effective risk management. But the literature on the perceived risk of climate change among individuals with insurance in Nepal particular in relation to the occurrence and intensity

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of extreme weather events, along with the impact of these perceptions on expectations about insurance products and prices, remains limited. These perceptions are key to understanding why some policies cannot be created by insurers as they would otherwise be undervalued and would not meet the needs and expectations of their clients, and yet remain financially sustainable.

The connection between extreme weather events, geographical exposure, and insurance risk is under explored concerning the case of Nepal. Regional exposure to climate risks is dramatically different and a more localized methodology is required to examine the influence of factors on insurance risk in Nepal.

Research Objective s

The main objective of the study is to analyse the climate change and the level of insurance risk in Nepal. The other specific objectives are as follows:

i. To examine the relationship between non-life insurer towards factors of climate change and level of insurance risk in Nepal.
ii. To analyze the impact of frequency of extreme weather events, severity of weather events, climate change regulations, insurer's risk management practices, and geographical exposure on insurance risk in Nepal.

Literature Review

Theoretical Review

Climate change has turned out to be a major element in the insurance risk that necessitated an in-depth analysis of theoretical views. Risk and uncertainty theory, theory of market efficiency, risk pooling and diversification theory and adaptation to climate change theory are taken to come up with a research framework and to know the perception of the non-life policy holders in relation to the climate change and insurance risk.

Risk and Uncertainty Theory: The risk and uncertainty theory plays a very important role in explaining the price of insurance particularly in climate change. It presupposes that the premiums set by the insurers depend on the unpredictability and the possible role of the future events such as extreme weather (Hartwig, 2009). The denser and more intensive such events are due to the climate change, the higher is the risk of the uncertainty and this causes the insurers to update the pricing and the underwriting models. Kousky et al. (2024) note that it is necessary to integrate the risks connected with climate, which is supposed to be appropriate in geographically vulnerable regions, to understand the general risk picture of policyholders and reflect it appropriately.

Theory of Market Efficiency: Market efficiency theory is the opinion that insurance prices should be anchored on the accessible on risk information (Fama, 1970). The insurance firms are utilizing the information of the historic weather, geographical position and weather forecast to adjust the premiums in case of climate change. The growing unpredictability of extreme occurrence creates a natural necessity to keep on changing pricing strategies, and the resulting

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success of the market response to changes in climate risk lies in the success of market responses.

Risk Pooling and Diversification Theory: The risk pooling and diversification theory explains why the insurance companies are effective in mitigating risks with the disposition of the potential losses among a large variety of clients in their portfolios (Merton, 1995). The diversification can be compromised by the large geographical exposure and lead to higher premiums and different pricing strategies (Kousky et al., 2024). This theory underlines the significance of location-based risks as a factor of determining the insurance products price.

Adaptation to Climate Change Theory: The climate change adaptation theory puts emphasis on reducing personal and institutional vulnerability (Adger, 2006). Adaptation is also necessary in order to remain profitable and sustainable, which could be in the form of pricing mechanisms (e.g. higher premiums of at-risk areas or incentive to take proactive adaptation, e.g. flood-resistant buildings).

The theory is closely linked with the study, which is elaborated as a theoretical underpinning of the study. Firstly, in the risk and uncertainty theory, there is increased uncertainty and volatility in losses due to the increasing frequency and intensity of extreme weather events, especially in areas with high geographic exposure. The market-efficiency theory holds that market risks and regulatory developments ought to be reflected in prices and risk assessments, but informational asymmetries and regulatory lags may slow the exercise of that reflection. The risk pooling and diversification theory also reveals that the relationship between climate-related losses undermines the benefits of diversification and hence accumulate the risk among the insurers. Lastly, the climate-change adaptation theory highlights the importance of insurers' risk-management activities and regulatory responses as adaptive mechanisms to reduce, but not completely eliminate, climate-related insurance risk.

Empirical Review

Belay et al. (2017) studied the role of smallholder farmers in Central Rift Valley in adapting to climate change in Ethiopia. The study established factors that affect adaptation strategies of farmers with the help of a multinomial logit model. Findings revealed that 90 percent of farmers felt the climate variability and 85 percent of them implemented strategies, including crop diversification, soil and water preservation, and planting trees. Access to resources and household demographics were identified to be crucial determinants, and there is a need to enhance adaptive capacity through the support of institutions. Runting et al. (2017) surveyed the inclusion of climatic change into the assessment of ecosystem services. By synthesizing the available literature, they identified 59, 24, and 13 percent negative effects, mixed effects, and positive effects, respectively. The study conducted by Pregnolato et al. (2017) examined the effects of climate change on transport systems in cities during pluvial flooding. They determined the disruption costs in a more realistic way compared to the traditional approaches by using an integrated framework that used flood simulations and transport data in Newcastle Upon Tyne, UK. The research estimated that in the year 2080s a 1-in-50-year flood could raise disruption in travel by 66 percent and focused adaptation could cut delays by 32 percent.

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Thistlethwaite and Wood (2018) examined how the insurance industry can manage climate risk within a framework of Rescaling, to include the temporal and spatial uncertainty. The analysis of the U.S. National Association of Insurance Commissioners Climate Risk Disclosure Survey through content analysis indicated that there was a low level of climate change integration in the process of risk management by primary insurers but high levels of reinsurers. They highlighted the organizational issues in climate risk management and suggested the rescaling as a response assessment mechanism. Using Global Climate Risk Index, Huang et al. (2018) sought to study how a climate risk impacts the performance and financing decisions of firms. They established that companies operating in areas with high exposure to severe weather conditions were more likely to maintain a larger amount of cash, lower short-term debts and prefer long-term funding as well as to pay lower dividends.

The systematic review study by Flood et al. (2018) on the use of serious games to adapt to climate change measured the capability of these games to promote social learning and behavior change. The study was done with a framework founded on cognitive, normative, and relational learning and found that trust among the stakeholders, effective facilitation, and debriefing were fundamental to success. Kefi et al. (2018) evaluated the direct flood losses in Hanoi, Vietnam, in climatic change conditions. The inclusion of flood depth, land use and property data in spatial analysis estimated a 26 percent rise in the damage caused by floods by the year 2030 as a result of climate change and urban growth. The use of adaptation measures, such as lake restoration and water-sensitive urban design, can decrease the damage by 8-29, which highlights the significance of active planning and prevention of floods.

Ameli et al. (2020) examined the concept of climate finance and institutional investor transparency. Its argument in the study was that simply disclosure is not enough in getting markets aligned with climate objectives. Results were able to point out that behavioral bias and strategic constraints impede the ability to mobilize climate financing effectively, and therefore more extensive frameworks could be necessary than are supported by the efficient market hypothesis. Averchenkova et al. (2021) tested the effectiveness of strategic climate legislation by using the UK Climate Change Act assessed in terms of stakeholder interviews. The results indicated that the Act offered a long-term structure, enhanced institutional procedures and forward-thinking policy. Folque et al. (2021) observed the effectiveness of sustainable investment (SI) strategies in ESG and climate risk management strategies. They demonstrated that negative screening strategies have lower effectiveness, and multi-criteria ESG approaches are more effective in reducing risks. The research provided an insight into how the investors should incorporate the ESG factors in the portfolios. A bibliometric analysis by Nobanee et al. (2022) of the scholarly outputs in the area of climate change, environmental risks, and insurance between 1986 and 2020 was done to trace the development of the area through collaborative networks. Their mapping identified seven prevalent research directions: risk management, environmental impact, flood insurance, environmental economics, global warming, public-private partnerships, and natural hazards as climate-change causes of insurance risk.

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Adhikari and Safaee (2023) examined obstacles and potentials of the private sector, in terms of investing in climate adaptation. Qualitative assessment revealed that high project risk, absence of bankable projects, and insufficient knowledge of climate risks were some of the top challenges. Pankratz et al. (2023) analyzed the impact of heat exposure on the performance of firms. They connected temperature data and financial results to discover that an increase in hot days by one standard deviation decreased revenues by 0.6 percent and operating income by 1.8 percent. These findings implied that capital markets do not recognize the economic cost of extreme heat. Through empirical analysis, De Angelis et al. (2023) established the reduction of carbon emissions by the firms as the wealth share of the green investors rose, especially in expectation of tightening of the regulations and technology improvements. Nevertheless, the influence of investors on future climate risks decreased due to uncertainty of future climate, which emphasized the conditional and long term effects of green investment.

Hamzeh et al. (2024) assessed the practices of climate change underwriting in the insurance sector of Iran. In the surveys of 35 experts and international authorities, the study established that there is a lack of incorporation of climate risks in underwriting, with few insurers possessing detailed mitigation strategies. The study underlined the use of pricing-based risk, disaster modeling and resilient infrastructure as important in the management of climate risk. Kousky et al. (2024) reviewed the lessons of policy in the U.S. property insurance market, especially Florida. They analysed policy and regulatory decision using scenario analysis to find out their impact on disaster recovery, market stability, and outcomes in terms of socioeconomics. They argued that the short-term policy interventions have a long-term effect on the insurance markets, and that changing the strategies of adaptation should be fair and progressive.

In one study, Alokla et al. (2025) found that a range of climate-change risks has an impact on the credit exposure of insurance companies and used a global sample of 150 insurance companies operating in 31 countries during 2001-2022. The authors have developed a new climate-risk indicator which is the synthesis of four main factors, namely, hydrological hazards, temperature extremes, severe meteorological events, and water-related risks. Their analysis has revealed that climate-change risk exposure and credit risk have a statistically significant negative correlation, which suggests that increased exposure to climate risk significantly increases the likelihood that insurers would default. Moreover, the research singled out the hydrological risk and extreme weather events (e.g., wildfires) as especially powerful predictors of the heightened default risk amongst insurers. Using 20112021 panel data data on 248 Chinese insurance companies, Xu et al. (2025) examined the effects of climate risk on their operational performance. Physical climate risk was measured through absolute temperature deviation, whereas the climate-transition risk was measured through an entropy-weighted composite index, which includes the uncertainty of the policy, the preference in the market, and technology innovation. The authors found that the negative impact of physical climate risk on operation efficiency is negative because of the increased natural-disaster losses. By contrast, climate transition risk showed a U-shaped relationship with efficiency: early performance decline was caused by the depreciation of high-carbon assets, and the improvement was then

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followed by a shift towards green insurance products and the development of insurance companies' business models.

Although there has been extensive research on the impacts of climate change in the agricultural, ecosystem, infrastructure, finance, and insurance sectors, the current body of research is heavily based on quantitative, firm-level, or policy-based studies in developed and large emerging economies. Previous insurance-related studies focus on credit risk, operational efficiency, underwriting practices, and regulatory frameworks, but pay little attention to how stakeholders perceive climate risk and its overall impact on insurance risk. What is more, the least developed and climate-exposed contexts, as in Nepal, are left in a critical state of under-exploration, especially in terms of a perceptual lens on insurers' risk-driving perceptions, regulatory sufficiency, and market readiness. Based on this, there is a clear lack of research on the impact of climate change on the perceived insurance risk in Nepal, and this study aims to fill this gap.

Research Methods

Research Design: A descriptive-explanatory research design is used to comprehensively address the objectives. The descriptive research design is employed to examine the perceptions of insured individuals regarding factors such as the frequency and severity of extreme weather events, climate change regulations, insurers' risk management practices, geographical exposure, and their influence on insurance risk. The explanatory research design is utilized to investigate the cause-and-effect relationships between independent variables—extreme weather events, climate regulations, geographical exposure, and risk management practices—and the dependent variable, insurance risk. The design allows the study to determine the impacts of certain factors associated with climate change on developing insurance strategies.

Population and Sampling Method: The population for this study comprises insured individuals associated with non-life insurance companies operating within the Kathmandu Valley, Nepal. These individuals represent a diverse group of policyholders exposed to varying degrees of climate-related risks, which directly impact their perceptions and experiences regarding insurance risk. To achieve a representative analysis, a sample of 424 insured individuals has been selected using convenience sampling. The Cochran formula Cochran (1977) is utilized for sample size determination. The sample size is based on gender domain. Therefore, the probability of picking male respondents for interview is p (assuming 0.5) the probability of selecting female respondents is 1-p = q i.e. 0.5. Using the above formula, the sample size $\mathbf{n} = \frac{(Z_{\frac{\alpha}{2}})^2 * p * q}{\delta^2}$ = 384 where, z is the selected critical value of desired confidence level i.e. 95%, p is the probability selecting male i.e. 50%, q = $1-p$ and e = error level i.e. 0.05. The sample size of 384 respondents is the minimum required but in the case of this research work, 424 respondents are considered to carry out the study.

Nature and Source of Data: The data used in the study is primary, and it was obtained with the help of online survey via Google Forms. This approach was implemented to effectively

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collect data about insured people in Kathmandu Valley and reduce logistical complications and cover a wide area. The survey questionnaire was designed based on the 5 point Likert scale, where the respondents were requested to express their agreement with different statements with regards to climate change, extreme weather events and how this affects the insurance risk. The scale with a set of options on the spectrum between strongly disagree (1) and strongly agree (5) enables one to have a subtle level of interpretation of the perception and attitude of the participants.

Data Collection Procedure: The research online questionnaire was created using Google Forms to collect the data of this study. The questionnaire was distributed via different social networks, such as WhatsApp, Viber, Messenger, Instagram, Gmail, etc., which had a broad target to the insured individuals in Kathmandu Valley. The method helped to access the sample easily and prompted contribution by a wide range of insured people, thereby increasing sample representativeness. Once the responses were obtained, the data collected was grouped and coded to achieve the data to undergo additional analysis.

Methods for analysis: Cronbach's Alpha was also tested to provide reliability and validity of the collected data, with assistance in determining internal consistency of the questionnaire. To analyze the data, SPSS version 25 was used, which provided powerful tools for frequency distributions, descriptive statistics, correlation, and regression analysis. These analytical tools were applied to provide answers to the research questions of the study and determine the relationships among the variables, such as frequency of extreme weather events, severity of weather events, climate change regulations, risk management practices of the insurer, geographical exposure, as well as their influences on insurance risk.

Research Framework and Definition of Variables

A logical relationship of climate change and insurance risk is specified as figure 1:

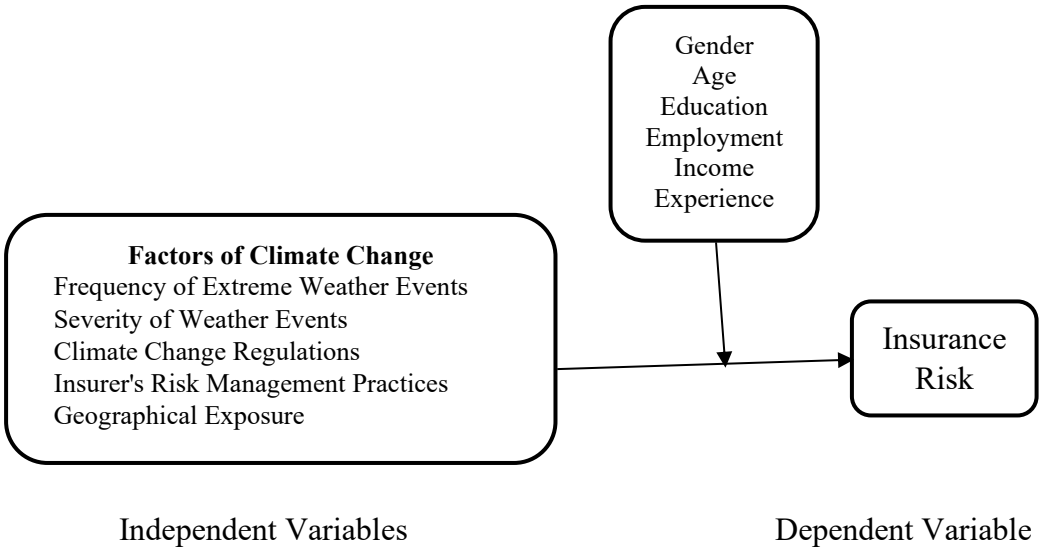

Figure 1. Research framework of the study

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Frequency of Extreme Weather Events: The frequency of extreme weather events is the frequency with which the disaster like floods and storms take place. Climate change has made them more frequent and therefore there are more insurance claims and suppositions of risks. Consequently, the increasing probability of high payouts causes insurers to modify their underwriting and premium price in order to cope with the risk.

Severity of Weather Events: Severity determines the extent and magnitude of detriment to extreme weather. More dire occurrences create more claims and economic burden on insurers. This forces the insurance firms to re-calculate the pricing models and enhance risk management in order to survive.

Climate Change Regulations: Climate change regulations are policies that mandate insurers to put into consideration the risk associated with climate in the coverage and pricing. They are regulations that affect the product design and encourage sustainable insurance practices, and how the industry responds to climate risks.

Insurer's Risk Management Practices: The risk management used by insurers is the methods to analyze and manage the climate-related damage. Reinsurance and risk modeling are examples of tools that help insurers to be solvent when climate risks increase which has direct influence on price and market stability.

Geographical Exposure: Geographical exposure is the exposure of insured properties to location. Risky locations are exposed to increased risks of climate and thus, insurers can provide high-premium rates and develop location-based covers.

Insurance Risk: Insurance risk refers to the risk of an insurance company experiencing a loss in terms of financial losses caused by climatic disaster related losses. As the number of extreme events that happen because of the increase in rate and severity of climate change increases, the uncertainty and potential loss increase among the insurers.

Multiple Regression Equation

The multiple regression equation is:

$$IR = \beta 0 + \beta_1 FEWE + \beta_2 SWE + \beta_3 CCR + \beta_4 IRMP + \beta_5 GE + e \quad \text{.....(1)}$$

Where,

IRP	= Insurance risk
$\beta 0$	= Intercept of the dependent variable (constant value)
$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$	= Beta coefficients of independent variables
FEWE	= Frequency of Extreme Weather Events
SWE	= Severity of Weather Events
CCR	= Climate Change Regulations
IRMP	= Insurer's Risk Management Practices
GE	= Geographical Exposure
e	= Error Terms

Hypotheses Development

The research examines the impact of extreme weather conditions, the intensity of such conditions, regulations on climate change, risk management practices of insurers, and

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geographical exposure to insurance risk. On the basis of established theories and prior research, the following hypotheses are formulated:

Hypothesis 1: The frequency of extreme weather events has a significant impact on insurance risk.

Hypothesis 2: The severity of weather events has a significant impact on insurance risk.

Hypothesis 3: The climate change regulations have significant impact on insurance risk.

Hypothesis 4: The insurer's risk management practice has a significant impact on insurance risk.

Hypothesis 5: The geographical exposure has a significant impact on insurance risk.

Results and Discussion

This paper used descriptive statistics to summarize the data, correlation analysis to evaluate the relationship among variables, and multiple regression analysis to determine important predictors of insurance risk. Data consistency was ensured by conducting reliability testing and the overall significance of the model was assessed by ANOVA.

Respondent's Profile: The profile of the respondent gives comprehensive demographic information about the participants of the study, including gender, age, education level, employment status, the income level annually, and work experience.

Table 1

Respondent's Profile

Category	Sub-Category	Frequency	Percentage
Gender	Male	257	60.6
	Female	167	39.4
Age	Below 20 years	28	6.6
	21-30 years	238	56.1
	31-40 years	122	28.8
	Above 40 years	36	8.5
Education Level	High School	78	18.4
	Bachelor's Degree	195	46.0
	Master's and above	151	35.6
Employment Status	Self-Employed	145	34.2
	Employed	198	46.7
	Unemployed	81	19.1
Annual Income Level	Below Rs. 5 Lakhs	191	45.0
	Rs. 5-10 Lakhs	167	39.4
	Above Rs. 10 Lakhs	66	15.6
Work Experience	0-4 years	200	47.2
	5-10 years	185	43.7
	10 years and above	39	9.1

Note. Field Survey, 2025

The demographic profile of the respondents is presented in Table 1. The sample is dominated by male (60.6%), as females represent 39.4 percent. The respondents are mostly aged 21-30

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years (56.1%), with 31-40 years (28.8) being the next group, which implies a rather young sample. Education-wise, almost half of the respondents are well educated, having a bachelor's degree (46.0%), with 35.6 percent having a master's degree or above. With respect to employment, the majority of respondents are working (46.7%), followed by self-employed (34.2%). The distribution of income indicates that nearly 45 percent of the respondents earn less than Rs. 5 lakhs per annum (45.0%). Also, the respondents with a work experience of 04 years (47.2%) or less are more than half of the total respondents, indicating a relatively inexperienced workforce.

Descriptive, Reliability and Collinearity

The mean score, standard deviation as descriptive statistics, Cronbach's Alpha for reliability test and Tolerance, VIF for multicollinearity test are presented in Table 2. Each construct was measured with five items, and Cronbach's alpha ranged from 0.769 to 0.881, indicating acceptable to high internal consistency, and the scales demonstrated reliability. All the variables mean scores are within the range of 3.90 and 3.98, which would indicate that the respondents tend to agree to the statements regarding climate change and insurance risk factors on the high level. The standard deviation values range from 0.51 to 0.63, indicating a moderate range of perceptions among respondents. Moreover, values of tolerance are greater than the recommended tolerance 0.10, and the values of Variance Inflation Factor (VIF) are much lower than the critical value of 10 that clearly indicates that there is no multicollinearity between the independent variables. In general, the findings indicate that the measurement model is adequate to conduct further statistical analysis.

Table 2

Descriptive statistics, Reliability and Multicollinearity Test

Variables	No. of Item	Cronbach's Alpha	Mean	Std. Deviation	Tolerance	VIF
Frequency of Extreme Weather Events	5	0.769	3.96	0.60	.609	1.643
Severity of Weather Events	5	0.812	3.98	0.57	.554	1.804
Climate Change Regulations	5	0.881	3.98	0.51	.706	1.417
Insurer's Risk Management Practices	5	0.835	3.90	0.63	.677	1.477
Geographical Exposure	5	0.784	3.97	0.62	.631	1.585
Insurance Risk	5	0.876	3.96	0.58		

Note. Calculated from SPSS 25

Correlation Analysis

The correlation matrix presented in Table 3 presents the relationship between the Insurance Risk and Frequency of Extreme Weather Events (FEWE), Severity of Weather Events (SEW), Climate Change Regulations (CCR), Insurer's Risk Management Practices (IRMP), and Geographical Exposure (GE). The perceived insurance risk is strongly and positively related

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to the insurers risk management practices (r = 0.665, p less than 0.01) and extreme weather events (r = 0.624, p less than 0.01), as higher the risk management practices and the extreme weather event, the higher the perceived insurance risk. Another moderate positive correlation is found between insurance risk and severity of weather events (r = 0.594, p < 0.01), geographical exposure (r = 0.518, p < 0.01), and climate change regulations (r = 0.445, p < 0.01).

Table 3

Correlation Matrix

	IR	FEWE	SWE	CCR	IRMP	GE
IR	1					
FEWE	.624**	1				
SWE	.594**	.556**	1			
CCR	.445**	.598**	.515**	1		
IRMP	.665**	.427**	.401**	.522**	1	
GE	.518**	.465**	.463**	.539**	.512**	1

**. Correlation is significant at the 0.01 level (2-tailed).

The independent variables are also significantly and positively related to one another and the correlation coefficients are between moderate and relatively strong. It is worth noting that the frequency of extreme weather events has a significant correlation with the climate change regulations (r = 0.598, p < 0.01) and with the severity of weather events (r = 0.556, p < 0.01). Comprehensively, the findings show that there are significant correlations between the variables of the study, but they do not reach the critical levels, which point to multicollinearity not being a serious issue, and the variables can be included in the subsequent regression analysis.

Regression Result

The multiple regression results in Table 4 show the effects of the chosen factors on climate change and its impact on insurance risk. The model has strong explanatory power, with an R2 of 0.643, indicating that 64.3% of the variation in insurance risk is explained by the independent variables. The entire model is statistically significant (F = 70.035, p = 0.001), and the Durbin-Watson of 1.975 indicates no autocorrelation amongst the residuals.

The first hypothesis that the frequency of extreme weather events significantly influences the risk in insurance (p < 0.005) is supported. The statistically significant positive regression coefficient indicates that the frequency of extreme weather events increases insurance risk, leading to more claims and greater insurers' exposure. The hypothesis concerning the magnitude of weather events is also acceptable (p < 0.005) as the findings indicate that the effect on the insurance risk is positive and significant. This implies that the more severe and destructive weather risks are, the higher the insurance losses would be which leads to the general increase in risk to the insurance companies. Conversely, the hypothesis of the large effect of climate change regulations on the insurance risk (p > 0.005) is not accepted. It shows that climate change regulations have no statistically significant direct impact on insurance risk

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in the study setting, suggesting that regulatory impacts may be indirect or mediated by other variables.

Table 4

Regression Result

Basis	Unstandardized Coefficients		Standardized Coefficients	t value	p value
	B	Std. Error	Beta		
Constant	.658	.201		3.268	.001
Frequency of Extreme Weather Events	.387	.046	.401	8.450	.000
Severity of Weather Events	.116	.051	.114	2.300	.022
Climate Change Regulations	.014	.050	.013	0.286	.775
Insurer's Risk Management Practices	.127	.041	.140	3.102	.002
Geographical Exposure	.189	.044	.202	4.336	.000
R square = 0.643, F value = 70.035 (0.000), Durbin Watson = 1.975					

Dependent Variable: Insurance Risk

The hypothesis that the insurer's risk management practices affect insurance risk ($p < 0.005$) is accepted. The strong association indicates that insurers' internal risk evaluation and mitigation measures are influential in determining insurance risk in the face of climate challenges. Lastly, the hypothesis that the impact of geographical exposure on insurance risk is significant ($p < 0.005$) is confirmed. The positive and significant correlation demonstrates that the more individuals are exposed to climate-prone regions, the more likely and the larger the insurance claims, hence, enhancing the risk of insurance.

Discussion

The hypothesis was the frequency of extreme weather events have a significant impact on the insurance risk and it was proved. This finding aligns with that of Hamzeh et al. (2024), who noted that the increasing frequency of floods, storms, and droughts poses new underwriting and pricing challenges. Findings show that the higher the frequency of disasters, the greater the claims, which in turn exposes the insurers to more risks and perceived risk. It is also consistent with Alokla et al. (2025) and Xu et al. (2025) that extreme weather events are strong predictors of increased default risk among international insurers and overall efficiency of the insurance companies. The intensity of weather events in the second hypothesis showed a positive, statistically significant relationship with insurance risk, a finding corroborated by Hamzeh et al. (2024), who found that severe events overstated the impact on claims and premium costs, particularly on affordability in vulnerable regions. This implies that the economic cost of more catastrophic incidents is greater and insurers are forced to change their pricing design to stay afloat.

The hypothesis measuring the impact of climate change regulations was failed to show a statistically significant direct impact on insurance risk. This means that, within Nepalese context, the current climate-related regulatory provisions are not institutionalized yet

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internalized to the extent that they have a material impact on the risk perception of insurers or risk exposure. This result is opposite to the evidence on more advanced regulatory settings, including the United Kingdom, where Averchenkova et al. (2021) discovered that strategic climate laws offered a consistent long-term framework that reinforced institutional governance and improved risk assessment practices. This inconsistency can be attributed to regulatory inertia, insufficient enforcement of these rules, and a structural mismatch between the current regulatory demands and the severity and character of the climate-related risks faced by the insured persons.

The hypothesis concerning the risk management practices of insurers was proven, which is why Hamzeh et al. (2024) also noted that without disaster modeling and solid infrastructure, there can be no possible risk mitigation. The results confirm that internal assessment and risk mitigation plans have a significant impact on insurance risk. Lastly, the hypothesis on geographical exposure was also proven true, which is in accordance with Kousky et al. (2024) and Kefi et al. (2018) who found that extensive geographic risk could undermine diversification and largely rely on reported damages, which in turn affected the pricing and coverage practices of insurers.

It indicates that regular and extreme weather causes climate change, increasing Nepalese insurance risk by increasing claims and repricing. Although geographical exposure and domestic management are the main factors that affect risks, the current regulations indicate no direct effect. Geographic profiling and disaster modeling, therefore, have to be given first consideration by insurers in the quest to maintain financial sustainability amidst increasing environmental uncertainties.

Conclusion

The insured individuals exhibit a relatively high perception of the impact of extreme weather events, severity of weather events, climate change regulations, insurer's risk management practices, and geographical exposure on insurance risk.

The insurance risk is strongly and positively associated with insurers' risk management practices and the frequency of extreme weather events. Moderate positive relationships were observed with the severity of weather events, geographical exposure, and climate change regulations, indicating that increases in these factors are associated with higher perceived insurance risk.

The risk of insurance in Nepal is magnified to a large extent by more occurrence and intensity of extreme weather conditions, which increase the volume of claims and the monetary liability. Geographical exposure is established as the other important determinant, which states that location-related vulnerability has a direct impact on increasing the likelihood and extent of insurance losses. Although physical and geographical conditions play an extremely strong role, it was found that climate change regulations at present do not have a statistically significant direct effect on the insurance risk in the Kathmandu Valley. Moreover, the results are also emphasized to indicate that the internal risk management of insurers play a critical role in

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overcoming climate-related uncertainties and achieving stability at the institutional level. The study suggests that underwriting must be undertaken by insurers with greater emphasis on the incorporation of geographic risk profiling, changes in prices and advanced disaster modeling into their operational activities in order to ensure financial sustainability.

Implications

Practical Implications: The findings demonstrate the need to enhance the practice of operations and underwriting by Nepalese insurers through the systematic adoption of climate risk considerations in pricing, diversifying portfolios and managing claims. Since extreme weather frequency, severity, and geographical exposure are highly impactful to the insurance risk, advanced disaster modeling, location-sensitive risk analysis, and adaptive pricing should be considered a priority of the insurers. Moreover, the high relevance of the internal risk management practices demonstrates that the institutional strengthening of the financial stability under the growing climate-related uncertainties conditions requires the improvement of the institutional capacities, data analytics, and risk mitigation strategies.

Theoretical Implications: This paper adds to the climate risk and insurance literature by offering perceptual evidence of a developing and climate-exposed economy, thus expanding the risk and uncertainty theory and climate adaptation theory to a firm-level financial or regulatory framework found in developed market. The results substantiate the precedence of physical climate risks and internal organizational capabilities in determining the insurance risk, as well as indicate the small explaining power of regulatory factors in loosely institutionalized settings. This further develops theoretical knowledge of the role of contextual factors in the communication of climate change effects into insurance risk.

Policy Implications: In policy terms, the non-existence of statistically significant regulatory impact implies a need to enhance the quality of the design, implementation and practical applicability of the climate change regulations in Nepal. To further align regulatory frameworks with local climate realities, improve enforcement systems, and encourage regulators and insurers to collaborate to promote standardized climate risk disclosure and catastrophe modeling, and to incentivize the purchase of climate-resilient insurance products, these measures should be encouraged. These would enhance the regulatory ability to reduce insurance risk and promote long-term sectoral resiliency.

Limitations and Further Research

The study focuses on the Kathmandu Valley, which may not reflect the experiences of insured persons in other regions or rural areas. The sample of 424 insured person's use of convenience sampling via online surveys (Google Forms) may not fully represent the broader insured population in Nepal, limiting the generalizability of the findings. The use of convenience sampling may introduce selection bias, as participants with greater access to online surveys may not reflect the entire insured population.

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The study found no direct statistical effect of the climate change regulations, so additional research is required to examine possible indirect or mediating factors that may affect this correlation. Moreover, although the present study was aimed at policyholders' views, further investigations should incorporate actual underwriting and financial loss outcomes to go beyond subjective ratings. Furthermore, studies on the application of technology and innovation, data analytics, machine learning, and climate modeling can also show how to enhance risk prediction and improve pricing accuracy while entering into an insurance contract.

Transparency Statement: The authors confirm that this study has been conducted with honesty and in full adherence to ethical guidelines.
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Authors' Contributions: The authors conducted all research activities i.e., concept, data collecting, drafting and final review of manuscript.

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