Climate – Related Risks Faced by Entrepreneurs in Puducherry: An Economic Analysis

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Abstract

Climate change has emerged as a significant economic challenge for entrepreneurs, particularly those operating micro and small enterprises. The present study examines the climate-related risks faced by entrepreneurs in the Puducherry Region, their economic consequences, and the adaptation strategies adopted to improve business resilience. The study adopts a descriptive and analytical research design based on a sample of 250 entrepreneurs selected through purposive and convenience sampling methods. Primary data were collected using a structured questionnaire covering socio-economic characteristics, climate-risk exposure, economic impacts, awareness, adaptation strategies, access to finance and insurance, and business resilience. The data were analysed using descriptive statistics, ranking techniques, the chi-square test, correlation analysis, and multiple regression analysis. The findings indicate that extreme heat is the most commonly reported climate-related risk, affecting 81.6 per cent of respondents, followed by heavy rainfall (75.6 per cent) and electricity interruption (72.4 per cent). The major economic consequences include increased operating costs (68.4 per cent), reduction in sales (65.2 per cent), and loss of working days (63.2 per cent). Emergency savings are the most commonly adopted adaptation strategy (58.4 per cent), whereas only 24.4 per cent of respondents reported purchasing business insurance. The correlation analysis indicates a positive relationship between climate-risk exposure and economic impact ($r = 0.62$). The regression results show that adaptation adoption has the strongest positive association with business resilience ($\beta = 0.41$), while climate-risk exposure has a negative association ($\beta = -0.31$). The study highlights the importance of financial preparedness, affordable insurance, climate-risk awareness, resilient infrastructure, and effective adaptation measures. It recommends coordinated action by entrepreneurs, financial

institutions, and policymakers to strengthen the resilience and sustainability of entrepreneurial activities in the Puducherry Region.

Keywords: Climate Change, Entrepreneurs, Climate-Related Risks, Economic Impact, Adaptation Strategies, Business Resilience, Puducherry.

Introduction

Climate change has increasingly become an economic and entrepreneurial concern. Changes in temperature, rainfall, flooding, cyclones and other extreme weather conditions directly influence business operations and economic performance. Micro and small enterprises are particularly exposed because many operate with limited financial resources, restricted access to insurance and inadequate technological capacity. The present study examines climate-related risks faced by entrepreneurs in the Puducherry Region, with particular attention to their economic consequences and adaptation strategies.

Objectives of the Study

- To identify the major climate-related risks faced by entrepreneurs.
- To assess the economic effects of climate-related risks on entrepreneurial activities.
- To examine the adaptation strategies adopted by entrepreneurs.
- To analyse the relationship between climate-risk exposure and economic impact.

Research Methodology

❖ Study Design

The study adopts a descriptive and analytical research design.

❖ Study Area

Puducherry Region, covering selected locations where micro and small enterprises operate.

❖ Sample Size

250 entrepreneurs selected through purposive and convenience sampling.

❖ Data Collection

- Primary data collected using a structured questionnaire covering:
- Socio-economic and business profile

- Climate-risk exposure
- Economic impact of climate-related risks
- Climate-risk awareness
- Adaptation strategies
- Access to finance and insurance
- Business resilience

❖ **Statistical Tools**

- Descriptive statistics (percentages, frequency distributions)
- Ranking techniques
- Chi-square test
- Correlation analysis
- Multiple regression analysis

Data Analysis and Interpretation

Table 1: Socio-Economic and Business Profile of the Respondents in Puducherry (N = 250)

Variable	Category	Frequency	Percentage
Gender	Male	155	62
	Female	95	38
Age	Below 30 years	52	20.8
	31-45 years	118	47.2
	Above 45 years	80	32
Business Type	Retail	62	24.8
	Food and Hospitality	48	19.2
	Manufacturing	35	14
	Services	55	22
	Trading/Street Business	50	20
Experience	Below 5 years	70	28
	5-10 years	96	38.4
	Above 10 years	84	33.6

Profile of Respondents (N = 250)

The table shows that 62% of respondents are male and 38% are female. The largest age group is 31–45 years (47.2%). Retail businesses account for the highest share at 24.8%, followed by service enterprises at 22%. More than 70% of entrepreneurs have operated their businesses for at least five years.

Table 2: Climate – Related Risks Faced by Entrepreneurs

Climate-Related Risk	Respondents Affected	Percentage	Rank
Extreme Heat	204	81.6	1
Heavy Rainfall	189	75.6	2
Electricity Interruption	181	72.4	3
Flooding/Waterlogging	168	67.2	4
Transportation Disruption	157	62.8	5
Cyclone/Strong Winds	143	57.2	6
Water Scarcity	126	50.4	7
Supply-Chain Delay	119	47.6	8

Extreme heat is the most commonly reported risk (81.6%), followed by heavy rainfall (75.6%) and electricity interruption (72.4%). Flooding and transportation disruption also significantly affect business operations.

Table 3: Economic Effects of Climate Risks

Economic Effect	Frequency	Percentage
Increase in Operating Costs	171	68.4
Reduction in Sales	163	65.2
Loss of Working Days	158	63.2
Damage to Stock or Equipment	132	52.8
Reduced Labour Productivity	147	58.8
Delay in Supply of Materials	139	55.6
Increase in Borrowing/Emergency Expenses	101	40.4
Temporary Business Closure	76	30.4

The most significant economic effect is increased operating costs (68.4%), followed by reduction in sales (65.2%) and loss of working days (63.2%). Nearly one-third of entrepreneurs experienced temporary business closure.

Table 4: Adaptation Strategies Adopted

Adaptation Strategy	Frequency	Percentage
Maintaining Emergency Savings	146	58.4
Installing Fans/Cooling Systems	139	55.6
Using Alternative Suppliers	117	46.8
Storing Additional Inventory	112	44.8
Using Digital Sales/Online Payment	104	41.6
Protecting Stock from Water Damage	98	39.2
Purchasing Business Insurance	61	24.4
Installing Renewable Energy Systems	39	15.6
Taking Formal Climate-Risk Training	34	13.6

Emergency savings are the most common adaptation measure (58.4%). However, only 24.4% have business insurance and just 13.6% received formal climate-risk training, indicating reliance on informal risk management.

Table 5: Mean Score of Climate-Risk Exposure

Risk Indicator	Mean Score	Standard Deviation	Interpretation
Extreme Heat	4.12	0.81	High
Heavy Rainfall	3.88	0.94	High
Electricity Disruption	3.76	1.02	High
Flooding	3.54	1.11	Moderate-High
Transportation Disruption	3.41	1.08	Moderate-High
Water Scarcity	3.02	1.19	Moderate

Extreme heat has the highest mean score (4.12), indicating it is the most severe climate pressure. Heavy rainfall and electricity disruption also record high scores.

Table 6: Chi-Square Test Results

Variables Tested	Chi-Square Value	Degrees of Freedom	p-value	Result
Business Sector and Climate-Risk Perception	18.642	4	0.001	Significant

Hypothesis: There is no significant association between business sector and perception of climate-related risk.

The p-value (0.001) is less than 0.05, so the null hypothesis is rejected. There is a significant association between business sector and climate-risk perception.

Table 7: Correlation Analysis

Variables	Economic Impact	Adaptation Adoption	Business Resilience
Climate-Risk Exposure	0.62	0.38	-0.46
Economic Impact	-	0.29	-0.58
Adaptation Adoption	-	-	0.64

Note: indicates significance at 1% level.

Climate-risk exposure is strongly correlated with economic impact (r = 0.62). Adaptation adoption shows a strong positive relationship with business resilience (r = 0.64).

Table 8: Multiple Regression Analysis

Independent Variable	Beta Coefficient	t-value	p-value
Climate-Risk Exposure	-0.31	-4.82	0
Climate-Risk Awareness	0.18	2.91	0.004
Financial Preparedness	0.29	4.36	0
Adaptation Adoption	0.41	6.27	0
Insurance Access	0.16	2.48	0.014

Dependent Variable: Business Resilience

Model Statistics: $R^2 = 0.52$, Adjusted $R^2 = 0.50$, F-statistic $p < 0.001$

The model explains 52% of the variation in business resilience. Adaptation adoption has the strongest positive effect (β = 0.41), while climate-risk exposure has a negative effect (β = -0.31).

Table 9: Hypothesis Testing Summary

Hypothesis	Decision	Interpretation
H01: Socio-economic characteristics and climate-risk perception	Rejected	Perception varies by business sector
H02: Climate-risk exposure and economic impact	Rejected	Significant positive relationship
H03: Climate-risk awareness and adaptation adoption	Rejected	Greater awareness leads to higher adaptation

Findings

Extreme heat (81.6%) and heavy rainfall (75.6%) are the most prevalent climate risks. Increased operating costs (68.4%) and reduced sales (65.2%) are the primary economic impacts.

Emergency savings (58.4%) is the most common adaptation strategy, while insurance coverage is low (24.4%).

There is a significant positive correlation between climate-risk exposure and economic impact (r = 0.62).

Adaptation adoption strongly predicts business resilience (β = 0.41).

Business sector significantly influences climate-risk perception (p = 0.001).

Recommendations

For Entrepreneurs

- Maintain emergency savings equivalent to at least 3 months of operating expenses.
- Invest in cooling systems and water-proofing measures.
- Diversify suppliers and customer channels (including digital sales).

- Consider business insurance for climate-related risks.
- For Financial Institutions:
- Develop affordable climate-risk insurance products for MSMEs.
- Offer low-interest loans for climate-resilient infrastructure.
- Provide financial literacy programmes on risk management.

For Policymakers

- **I**mprove drainage systems and flood management in business areas.
- Ensure reliable electricity supply during extreme weather.
- Establish early-warning systems for floods, cyclones and heat waves.
- Provide subsidies for renewable energy and climate-resilient technologies.
- Organise training programmes on business continuity planning.

Conclusion

Climate-related risks have significant economic consequences for entrepreneurs in Puducherry. Extreme heat, heavy rainfall and electricity disruption are the most serious risks, leading to increased costs, reduced sales and business interruptions.

The study finds that entrepreneurs with emergency savings, insurance, digital facilities and alternative suppliers demonstrate higher business resilience. However, low insurance coverage and limited formal training indicate that many entrepreneurs manage climate risks informally.

Strengthening financial preparedness, improving infrastructure and promoting adaptation measures are essential for building climate-resilient entrepreneurship in the region.

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