

FINAL PROJECT REPORT

Extreme Heat Loss and Damage: Small Business Evidence from India

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Implemented by: All India Disaster Mitigation Institute (AIDMI)

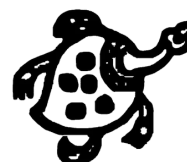
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This project was implemented as part of a larger project named Strengthening Inclusive Disaster Risk Governance for Climate Resilience in Asia (SIDRRA), co-implemented by a consortium led by the International Rescue Committee (IRC), the Asian Disaster Reduction and Response Network (ADRRN), and Duryog Nivaran.



Strengthening Inclusive Disaster Risk Governance for Climate Resilience in Asia (SIDRRA)





EXTREME HEAT LOSS AND DAMAGE: SMALL BUSINESS EVIDENCE FROM INDIA

2026

Prepared by All India Disaster Mitigation Institute (AIDMI). All photographs in this report were taken by AIDMI. May 2026.

The study was conducted by the All India Disaster Mitigation Institute (AIDMI). AIDMI also acknowledges the support received from Practical Action India during the study process. The study was supported under the SIDRRA (Strengthening Inclusive Disaster Risk Governance for Climate Resilience in Asia) Project, led by Duryog Nivaran.

Cover page: A small business worker in India adjusts a fan during extreme heat, underscoring how rising temperatures disrupt daily work, productivity, and livelihoods across urban areas.

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ABBREVIATIONS

AIDMI	All India Disaster Mitigation Institute
BPL	Below Poverty Line
COP	Conference of the Parties
GDP	Gross Domestic Product
GPS	Global Positioning System
HAP	Heat Action Plan
ILO	International Labour Organisation
IMD	India Meteorological Department
IPCC	Intergovernmental Panel on Climate Change
KII	Key Informant Interview
L&D	Loss and Damage
MFI	Microfinance Institution
MNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MoEFCC	Ministry of Environment, Forest and Climate Change
NDMA	National Disaster Management Authority
NGO	Non-Governmental Organisation
PM-Kisan	Pradhan Mantri Kisan Samman Nidhi
SHG	Self-Help Group
UNFCCC	United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY

Extreme heat is a slow-onset climate risk that is gaining recognition within India's disaster governance system, with some states notifying heatwaves as a state-specific or local disaster. This progress creates an important opportunity to strengthen evidence, relief, and compensation systems for informal small businesses, which continue to experience recurring income loss, health impacts, and productivity decline during heat events. This study presents one of the first systematic cross-city evidence on how extreme heat and compound climate events translate into quantifiable loss and damage for small businesses across five Indian cities: Ahmedabad (Gujarat), Cochin (Kerala), Kolkata (West Bengal), Guwahati (Assam), and Rewa (Madhya Pradesh). The study was conducted by AIDMI, supported by the *Duryog Nivaran* under its SIDRRA project that aims to enhance adaptability and strengthen resilience among at-risk communities in Asia and amplify local voices in decision-making processes. AIDMI acknowledges the support of Practical Action India while conducting this study.

A total of 150 small business owners were surveyed using structured instruments supplemented by qualitative interviews. The sample is predominantly female (68%), with 56% living below the poverty line (BPL) and 75% having completed only primary or no formal education. This demographic profile underscores that the people most exposed to climate risk are also the least equipped structurally, financially, and institutionally to respond.

The study reveals near-universal income loss. 95.3% of respondents reported loss of income due to extreme heat in the past year. Of these, 40% lost income for under a week, 22.7% for one to two weeks, and 29.3% for more than two weeks, with the remaining 4.7% reporting no loss. Heatwaves were the most frequently cited disruptor (80.7% of respondents), followed by heavy rainfall (71.3%) and unseasonal rain (53.3%).

Health impacts compound economic losses significantly. More than half of respondents (52.7%) reported heat-related illnesses in their households, and 62.7% reported difficulty sleeping at night due to heat or humidity. Mental health was also severely affected, with 38% reporting sleep-related disturbances and 33.3% reporting increased stress. Despite this, only 44.7% reported any increase in healthcare expenditure, suggesting widespread non-reporting and inadequate health-seeking behaviour driven by cost barriers.

Household expenditure burdens escalated due to extreme heat. Nearly 60% of respondents spent up to 10% more on water, while 62% faced slightly higher energy costs for cooling. Food commodity prices rose for the majority, with 65.3% reporting a slight increase of up to 10%. Power outages disrupted over 88% of respondents, with 47.3% facing multiple short outages.

Adaptation capacity is critically low. Nine in ten respondents made no new investment after the last major climate event, citing financial constraints. Three in four had not considered any financial strategy for managing climate-related losses. Most respondents remain reliant on passive information channels such as television (58%) and community text alerts (42%), with only 8.1% having made structural home modifications for climate protection.

The Resilience Fund demonstrates that targeted financial support can meaningfully shift outcomes. Among recipients, 96.7% utilised the support, 94.7% implemented climate resilience measures, and 72% found the funds very helpful in managing climate impacts. These results point to the transformative potential of accessible, micro-scale climate finance.

Integrating small business economic protection into city-level Heat Action Plans (HAPs); deploying anticipatory finance mechanisms, including micro-grants, community-based savings, and direct cash transfers, ahead of heat seasons, reduces avoidable loss.

Establishing people-centred climate finance frameworks with special provisions for informal women workers, BPL households, and home-based producers and connecting field-level loss and damage (L&D) evidence to National Disaster Management Authority (NDMA) guidelines and United Nations Framework Convention on Climate Change (UNFCCC) Loss and Damage Fund mechanisms, helps tackle the issue. Introducing long-term income monitoring across heat seasons helps to move beyond recall-based assessments.

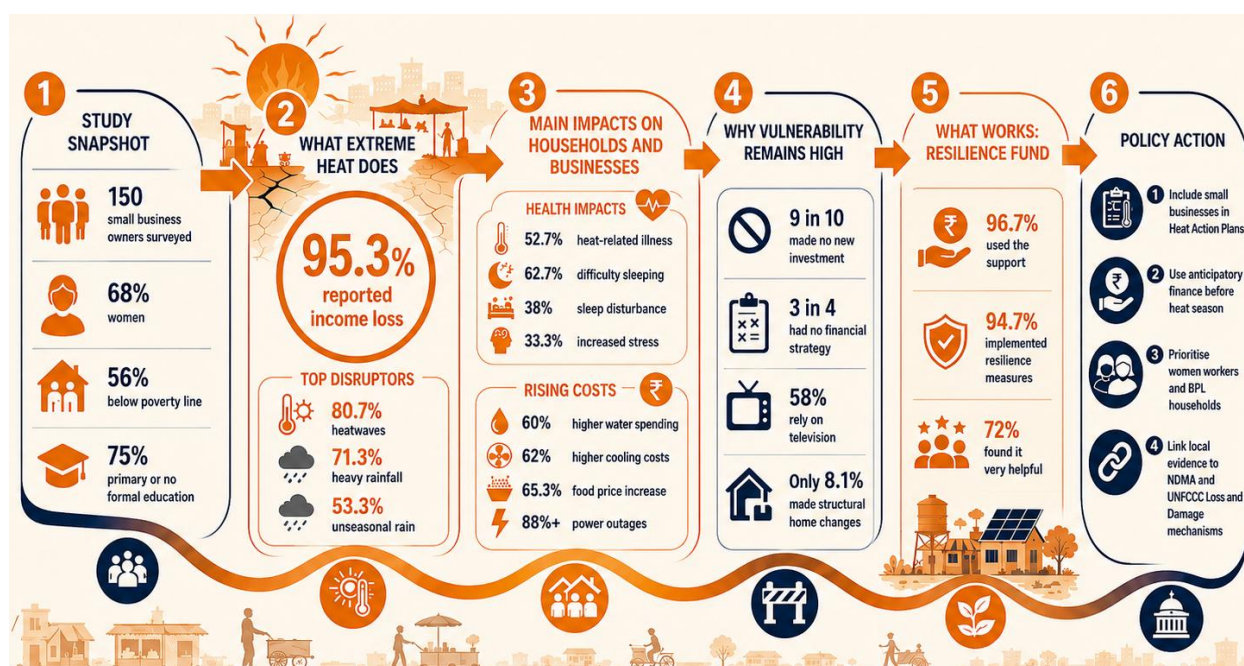


Figure 1: This visual summarises the report's key evidence from five cities, covering the respondent profile, income loss, heat-related health and business impacts, low adaptation capacity, benefits of Resilience Fund support, and priority policy actions for reducing avoidable loss and strengthening heat resilience.



A woman broom-maker works from her home-based workspace with a fan for relief during hot conditions. Extreme heat affects comfort, concentration, and productivity for small businesses that depend on long hours of manual work in poorly ventilated indoor or semi-outdoor spaces.

1. INTRODUCTION

India is experiencing an accelerating climate emergency. Between 2010 and 2024, extreme heat events increased in both frequency and intensity across the country, with average annual temperatures rising consistently above historical norms. In 2024 alone, multiple Indian cities recorded temperatures exceeding 45°C for prolonged periods, and the India Meteorological Department (IMD) issued heat action alerts across fourteen states simultaneously.¹ India's disaster governance system is increasingly recognising extreme heat as a serious public risk. Several states, including Tamil Nadu and Madhya Pradesh², have taken important steps to notify heatwaves as a state-specific or local disaster, enabling relief provisions for affected people. This emerging state-level recognition is a significant policy advance. However, livelihood-related loss and damage among informal small businesses remains insufficiently measured and only partially addressed within existing heat response, relief, and compensation mechanisms. This study builds on this progress by generating evidence on how extreme heat affects income, health, productivity, and adaptation needs among small businesses.

The consequences are borne most heavily by those who can least afford them. Street vendors, artisans, food and beverage sellers, fresh produce traders, and skilled service providers operate outdoors or in poorly ventilated spaces, directly exposed to rising heat. Their incomes are daily and irregular, their savings marginal, and their access to insurance, credit, or government compensation minimal. When a heatwave forces them to close for a week, or when heat stress leads to illness and hospitalisation, there is no safety net waiting for them.

The All India Disaster Mitigation Institute (AIDMI), drawing on over two decades of direct engagement with small businesses affected by climate hazards, identified a critical knowledge gap. While Heat Action Plans in Indian cities, particularly Ahmedabad's pioneering model, have contributed to meaningful reductions in heat-related mortality, the economic loss and damage accruing to small businesses remained largely unmeasured and unaddressed. This study was designed to fill that gap.

The study conducted between February to May 2026 and covers five cities that represent diverse climatic zones and livelihood contexts – Ahmedabad in Gujarat (hot and arid), Cochin in Kerala (humid tropical), Kolkata in West Bengal (humid subtropical), Guwahati in Assam (monsoon-dominated), and Rewa in Madhya Pradesh (semi-arid continental). Across these cities, 150 small business owners were surveyed using structured questionnaires deployed via KoboToolbox, supplemented by qualitative interviews to capture contextual depth.

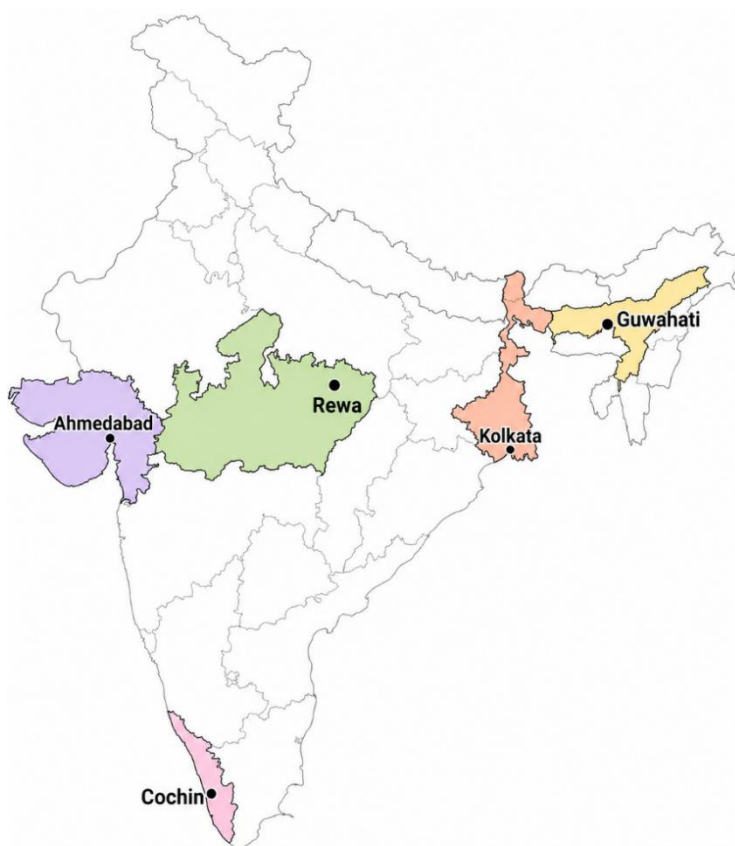
An intersectional lens was applied throughout the study design. Recognising that climate risk is not experienced uniformly, the sampling strategy gave priority to women business owners, below-poverty-line (BPL) households, households with elderly or child dependants, and businesses operating with the least structural protection. This approach reflects AIDMI's

¹ India Meteorological Department (IMD). (2024). Heat Wave Bulletins and State-wise Heat Action Alerts. Government of India. <https://mausam.imd.gov.in/>

² Tamil Nadu notified heatwave as a “State Specific Disaster” in October 2024, and Madhya Pradesh notified heatwave/hyperthermia as a local disaster with effect from summer 2025.

commitment to generating evidence that is both quantitative and qualitative, while remaining grounded in the lived experiences of small businesses most exposed to heat-related risks.

The study is further situated within the global discourse on Loss and Damage (L&D) under the United Nations Framework Convention on Climate Change (UNFCCC). The Santiago Network and the newly operationalised Loss and Damage Fund represent landmark policy shifts toward recognising and compensating unavoidable climate impacts.³ This study contributes ground-level evidence from small businesses to that discourse, arguing that informal economy actors, and the heat stress and livelihood losses they experience, must be made more visible in international loss and damage mechanisms.



The report is structured as follows: Section 2 establishes the conceptual framework; Section 3 describes the methodology; Section 4 presents findings on loss and damage and adaptation performance; Section 5 offers recommendations for policy and finance; Section 6 outlines a way forward for research and advocacy; and Sections 7–8 provide references and annexes.

2. CONCEPTUAL FRAMEWORK

This section outlines the conceptual basis of the study, including the broader climate and loss and damage discourse, the literature informing the research, and the analytical framework used to guide the study design and interpretation of findings.

2.1 Context

The conceptual grounding of this study sits at the intersection of three evolving global frameworks: the Loss and Damage discourse under UNFCCC, the Sendai Framework for Disaster Risk Reduction (2015–2030), and the growing body of research on heat as a livelihood threat in the Global South.

³ UNFCCC. (2019). Loss and Damage: Online Guide. United Nations Framework Convention on Climate Change. <https://unfccc.int/topics/adaptation-and-resilience/workstreams/loss-and-damage>

Extreme heat operates differently from sudden-onset disasters. Unlike floods or cyclones, it does not produce dramatic visible destruction. Instead, it erodes productivity quietly and cumulatively—reducing the number of hours a street vendor can stand at their stall, increasing the rate at which perishable goods spoil, driving up the frequency of health clinic visits, and compressing the already narrow margins on which small businesses survive. The IPCC (2022) identifies heat stress as one of the dominant vectors through which climate change will reduce labour productivity globally, with disproportionate impact on informal, outdoor, and heat-exposed occupations.⁴

In India, this manifests acutely. The International Labour Organisation (2019) estimates that heat stress could result in a loss equivalent to 5.8% of total working hours in South Asia by 2030.⁵ For small business owners in Indian cities, extreme heat is not a future projection but a present livelihood reality. AIDMI's prior work with more than 2,000 small businesses shows that heat-related income loss, reduced working hours, rising costs, and health stress are already affecting daily business continuity.⁶ Recent state-level recognition of heatwaves as a disaster risk is an important policy step. However, the economic losses faced by informal small businesses often remain under-measured in formal assessments and are not yet fully reflected in relief, compensation, insurance, or social protection systems.

The UNFCCC loss and damage framework, which anchors the international policy response to unavoidable climate impacts, can be understood through three connected elements: knowledge and coordination through the Warsaw International Mechanism, technical assistance through the Santiago Network, and financial support through the Fund for Responding to Loss and Damage.⁷ For this study, this tripartite framework provides the institutional scaffolding for documenting how extreme heat translates into concrete, measurable impacts on small businesses. It supports systematic evidence generation across five dimensions: income loss resulting from heat-forced closures and reduced trading hours; health costs from heat-related illnesses borne by business owners and their households; productivity decline due to diminished working capacity under sustained heat stress; adaptation limits that emerge when financial and structural barriers prevent meaningful protective action; and compensation needs that arise when residual losses exceed community capacity for self-recovery.

⁴ Intergovernmental Panel on Climate Change (IPCC). (2022). Sixth Assessment Report (AR6): Impacts, Adaptation, and Vulnerability. Cambridge University Press. <https://www.ipcc.ch/report/ar6/wg2/>

⁵ International Labour Organisation (ILO). (2019). Working on a Warmer Planet: The Impact of Heat Stress on Labour Productivity. ILO Publications, Geneva. https://www.ilo.org/global/publications/books/WCMS_711919/lang--en/index.htm

⁶ AIDMI. (2026). *Small Heat Resilience Measures: Big Impact in Small Towns and on Small Businesses in India*. Southasiadisasters.net, Issue No. 228, January 2026. Ahmedabad: All India Disaster Mitigation Institute (AIDMI). Available at: <https://aidmi.org/small-heat-resilience-measures-big-impact-in-small-towns-and-on-small-businesses-in-india/>.

⁷ UNFCCC. (2019). Loss and Damage: Online Guide. United Nations Framework Convention on Climate Change. <https://unfccc.int/topics/adaptation-and-resilience/workstreams/loss-and-damage>



A woman strings handmade products outside her home. Heat exposure affects concentration, comfort, and productivity, especially for small businesses where production depends on long hours of careful handwork.

2.2 Literature Synthesis

The literature on heat, livelihoods, and small business vulnerability converges on four core themes that directly inform this study.

Heat as a Productivity and Income Threat

The IPCC Sixth Assessment Report (2022) documents accelerating heat impacts on labour productivity, with the highest risks concentrated in agricultural and informal labour sectors in tropical regions.⁸ The ILO (2019) demonstrates that for every degree of wet-bulb temperature rise above 33°C, labour productivity falls by approximately 1% per hour of exposure.⁹ For small business owners working 8–12 hours daily in direct sun or poorly ventilated markets, this translates to measurable and recurring income loss that is never captured in Gross Domestic Product (GDP) statistics.

Economic Burden and Household-Business Interlinkages

The World Bank (2021) highlights that climate-driven increases in water, energy, and healthcare costs in South Asia create a 'triple burden' for low-income households: costs rise

⁸ Intergovernmental Panel on Climate Change (IPCC). (2022). Sixth Assessment Report (AR6): Impacts, Adaptation, and Vulnerability. Cambridge University Press. <https://www.ipcc.ch/report/ar6/wg2/>

⁹ International Labour Organisation (ILO). (2019). Working on a Warmer Planet: The Impact of Heat Stress on Labour Productivity. ILO Publications, Geneva. https://www.ilo.org/global/publications/books/WCMS_711919/lang--en/index.htm

simultaneously while income falls.¹⁰ AIDMI's Southasiadisasters.net series^{11 12 13} on heat governance and small business resilience highlights that extreme heat increases financial pressure on small businesses by reducing income, raising household and business costs, and limiting the ability to invest in protective measures. For many informal enterprises, household and business finances are closely connected; therefore, heat-related disruption affects not only daily earnings but also food, health, education, savings, and debt decisions. This study builds on that understanding by examining how heat-related loss and damage is experienced across both business and household levels.

Adaptation Effectiveness and Limits

The Government of India Heat Action Plans, particularly Ahmedabad's HAP¹⁴, was globally recognised as a model, have demonstrably reduced mortality. However, as the NDMA (2019) guidelines themselves acknowledge,¹⁵ HAPs remain primarily oriented toward health and emergency response rather than livelihood protection. Available evidence shows that measures such as shade, schedule adjustments, rest, and hydration can reduce immediate heat stress, but they may not fully prevent income loss where working hours, customer footfall, productivity, or business continuity are still affected¹⁶. There is a critical absence of evidence linking specific adaptation types to measurable reductions in economic loss, a gap this study directly addresses.

Finance, Compensation, and Social Protection Gaps

The UNFCCC Loss and Damage discourse has accelerated since the Conference of the Parties (COP) 27's establishment of the Loss and Damage Fund, but implementation mechanisms remain oriented toward large-scale national claims rather than micro-level livelihood losses.¹⁷

¹⁰ World Bank. (2021). South Asia's Hotspots: The Impact of Temperature and Precipitation Changes on Living Standards. World Bank Group. <https://openknowledge.worldbank.org/handle/10986/28723>

¹¹ AIDMI. (2024). Heatwave Deaths are Avoidable. Southasiadisasters.net, Issue No. 210, May 2024. <https://aidmi.org/heatwave-deaths-are-avoidable/>

¹² AIDMI. (2025). Urgency of Urban Heat Adaptation. Southasiadisasters.net, Issue No. 220, May 2025. <https://aidmi.org/urgency-of-urban-heat-adaptation-2/>

¹³ AIDMI. (2025). Heat as Humanitarian Crisis: What Local Organisations are Doing. Southasiadisasters.net, Issue No. 222, July 2025. <https://aidmi.org/heat-as-humanitarian-crisis-what-local-organisations-are-doing/>

¹⁴ Ahmedabad Heat Action Plan, 2019, AMC, NRDC. <https://www.nrdc.org/sites/default/files/ahmedabad-heat-action-plan-2018.pdf>.

¹⁵ National Disaster Management Authority (NDMA), Government of India. (2019). Guidelines for Preparation of Heat Action Plan. NDMA, New Delhi. https://ndma.gov.in/sites/default/files/PDF/Guidelines/guidelines_heatwave.pdf

¹⁶ ILO. (2019). *Working on a Warmer Planet: The Impact of Heat Stress on Labour Productivity and Decent Work*. International Labour Organization, Geneva. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40dgreports/%40dcomm/%40publ/document/s/publication/wcms_711919.pdf.

¹⁷ UNFCCC. (2022). Decision 2/CP.27 – Funding Arrangements for Responding to Loss and Damage Associated with Adverse Effects of Climate Change, Including a Focus on Addressing Loss and Damage (Glasgow Dialogue). United Nations Framework Convention on Climate Change. <https://unfccc.int/topics/adaptation-and-resilience/workstreams/loss-and-damage>

The World Bank (2021)¹⁸ and ILO (2019)¹⁹ both identify the absence of accessible, tailored financial instruments for informal workers as a structural barrier to resilience. This study's evidence on what communities actually demand—microfinance, micro-grants, and anticipatory cash transfers—provides the ground-level specificity that international finance discussions require.

2.3 Study Framework

The literature reviewed for this study highlights four recurring areas requiring systematic assessment: exposure and vulnerability of small businesses to extreme heat; the different forms of economic and non-economic loss and damage experienced; the effectiveness and limits of existing adaptation measures; and the continuing gaps in compensation, finance, and institutional support. Drawing from these findings, the study framework was developed to guide the research questions, survey modules, and analysis approach. This study is organised around the following framework.

Pillar	Focus	Study Questions Addressed
1. Exposure & Vulnerability	How do small businesses experience exposure, and what amplifies impact?	Business type, household dependency, work condition, service disruptions, frequency of disruptions
2. Typology of Loss & Damage	What types of loss result from extreme heat?	Income loss duration and frequency, health costs, water/energy/food expenditure increases, productivity rate, wellbeing and stress
3. Adaptation Measures & Performance	What measures are adopted, and do they reduce losses?	Cooling investments, behavioural adjustments, work hour modification, and financing sources
4. Limits & Compensation Gaps	What losses persist despite adaptation, and what support is needed?	Residual income loss, unmet needs, barriers to access support, demand for compensation and social protection, and anticipatory finance

This framework recognises that small businesses occupy a unique position at the intersection of household vulnerability and market exposure. A single business owner's illness does not merely affect their health; it removes the household's only source of daily income. A week of heat-forced closure translates not just into lost revenue but into depleted savings, deferred rent, and accumulated debt. The framework, therefore, integrates business-level and household-level impacts, capturing this compounding dynamic.

¹⁸ World Bank. (2021). South Asia's Hotspots: The Impact of Temperature and Precipitation Changes on Living Standards. World Bank Group. <https://openknowledge.worldbank.org/handle/10986/28723>

¹⁹ International Labour Organisation (ILO). (2019). Working on a Warmer Planet: The Impact of Heat Stress on Labour Productivity. ILO Publications, Geneva. https://www.ilo.org/global/publications/books/WCMS_711919/lang--en/index.htm

3. METHODOLOGY

This section describes the research design, study locations, sampling approach, data collection process, and analytical methods used for the study.

3.1 Research Design

This study adopted a mixed-method exploratory design, combining quantitative structured surveys with targeted qualitative interviews. The quantitative component generates statistically robust, multi-city data on loss and damage, adaptation behaviour, and support needs. The qualitative component captures contextual variation, decision-making logic, coping strategies, and lived experience.

3.2 Study Sites

Five cities were selected to represent diverse climatic and socioeconomic contexts across India. Each city contributes 30 respondents to the sample, ensuring equal geographic representation. Table 1 presents the selected study cities, states, and key livelihood groups represented in the sample.

Five Study Cities at a Glance			
City	State	Climate Type	Key Livelihoods
Ahmedabad	Gujarat	Hot & Arid	Artisans, Garments, Fresh Produce
Guwahati	Assam	Monsoon-Dominated	Animal Husbandry, Food, Skilled Trades
Kolkata	West Bengal	Humid Subtropical	Fresh Produce, Garments, General Goods
Rewa	Madhya Pradesh	Semi-Arid Continental	Farming, Artisans, General Goods
Cochin (Kochi)	Kerala	Humid Tropical	Fishermen, Food & Beverage, Skilled Trades

Table 1: Five Study Cities at a Glance — Location, Climate Type, and Key Livelihoods.

3.3 Sample

The study surveyed 150 small business owners, 30 per city, using purposive sampling guided by intersectional considerations. The sampling framework prioritised the following:

- Women business owners, who are disproportionately exposed to heat due to the nature of home-based and informal work
- Below-poverty-line (BPL) households, representing the most economically vulnerable
- Businesses operating with minimal structural protection: street stalls, open-air markets, and kutcha structures
- Households containing elderly members (above 60), both recognised high-risk groups

The resulting sample (as showing in table 2) is 68% female and 32% male, with 56% of respondents in BPL households and 75% having completed only primary education or no formal schooling. The modal monthly household income falls in the ₹10,000–15,000 range, reflecting the low-income nature of the study population.

Survey Sample Profile at a Glance				
150	5	68%	56%	75%
Total Respondents	Cities Covered	Female Respondents	Below Poverty Line	Primary / No Education

Table 2: Survey Sample Profile at a Glance – Key Demographic Statistics of 150 Respondents.

The purposive sampling approach prioritised small businesses likely to face higher heat-related livelihood risks. This included women-led businesses, BPL households, businesses operating in kutchra or poorly ventilated spaces, and respondents with limited formal education or caregiving responsibilities. These criteria were selected because gender, poverty, housing quality, education, and household care responsibilities can influence exposure, access to information, ability to adapt, and capacity to recover from income loss.

3.4 Data Collection

Data was collected in March 2026, timed to coincide with the onset of the heat season in northern and central India. The structured survey instrument was deployed via KoboToolbox, a digital mobile data collection platform, enabling real-time quality monitoring and Global Positioning System (GPS) verified location data.

The questionnaire covered nine thematic modules, which were developed in line with the study questions and the conceptual framework. These modules were designed to capture exposure and vulnerability, types of loss and damage, adaptation measures and their performance, and limits and compensation gaps. The modules included: general demographic information; impact on health; impact on livelihood; impact on household expenditure; impact on resources and services; anticipatory actions and adaptation; recovery support preferences; support needs; and follow-up on Resilience Fund utilisation. The instrument was piloted with a small group of respondents before full rollout. The pilot process identified and resolved issues with question sequencing, translation equivalence, and respondent comprehension. Field teams were oriented before data collection on interview technique, informed consent procedures, and data quality protocols.

Qualitative data were gathered through short key informant interviews (KIIs) with selected respondents. These interviews explored the lived experience of income loss, the decision-making calculus behind adaptation choices, and respondents' understanding of and expectations from government and non-government support systems.

All data collection exercises were conducted with the informed consent of respondents. Oral consent was obtained before beginning each interview, and respondents were informed about the purpose of the study and the voluntary nature of their participation. Personal information, including names and mobile numbers, was handled with care and used only for study-related follow-up where necessary. Data privacy was maintained during storage, analysis, and

reporting. Consent was also obtained before capturing any field photographs, and photos are used only where respondents agreed to such use.

3.5 Analysis Approach

Quantitative data were cleaned and analysed in two stages. Frequency distributions and valid percentages were computed for all variables, disaggregated by gender, state, and business type.

The analytical framework measured five core dimensions aligned with the framework: frequency and duration of income loss; adaptation type and prevalence; assessment of increased household expenditure burden; preparedness and coping capacity scoring based on respondents' self-reported actions and investments; and identification of residual loss and compensation gaps.

Qualitative data were analysed thematically, with emergent themes cross-referenced against quantitative findings to produce integrated, evidence-rich narratives.

4. FINDINGS: LOSS AND DAMAGE PERFORMANCE

In this report, the term “heat events” refers specifically to periods of extreme heat or heatwave conditions. The broader term “climate events” is used where respondents reported overlapping or compound impacts from multiple climate-related hazards, including heavy rainfall, flooding, unseasonal rain, cyclones, and drought, alongside extreme heat. Since many small businesses experience these risks simultaneously or sequentially, some findings reflect the combined effects of multiple climate stressors. However, the primary focus of this study remains extreme heat and related livelihood loss and damage.

4.1 Profile of Respondents

The study reached 150 small business owners across five Indian cities, with a demographic profile that reflects the study's deliberate focus on the most exposed and least protected segments of the informal economy. The characteristics of this population are not incidental to the findings; they are constitutive of them. Gender, education, poverty status, and housing quality are not background variables: they are the very factors that determine who absorbs the greatest heat-induced loss and receives the least support in response.

Business categories span the breadth of the urban informal economy: artisans (16%), food and beverage sellers (15.3%), skilled professionals such as cobblers and tailors (15.3%), fresh produce vendors (13.3%), garment businesses (11.3%), general goods traders (8.7%), animal husbandry (4.7%), fishermen (3.3%), and small and marginal farmers (0.7%). The overlap between business activity and dwelling is significant: 88% of respondents live in houses, and 12% in apartments, but 31.3% of houses are kutcha structures, made with tin, wood, or clay roof materials, that provide little thermal insulation and amplify heat exposure during heatwaves.

4.2 Direct and Indirect Economic Losses

Income Loss

The scale of income disruption documented in this study is stark. Only 7 of 150 respondents (4.7%) reported no income loss due to extreme heat in the past year. The remaining 95.3% experienced quantifiable income loss, distributed as follows in Table 3:

Duration of Income Loss	Number of Respondents	Percentage
No loss of income	7	4.7%
Loss of income for less than a week	60	40.0%
Loss of income for 1–2 weeks	34	22.7%
Loss of income for more than 2 weeks	44	29.3%
Prefer not to say / Don't know	5	3.3%
TOTAL	150	100%

Table 3: Duration of Income Loss Reported by Small Businesses Due to Extreme Heat (N = 150)

Of particular concern is the 29.3% who lost income for more than two weeks. For small businesses with modal monthly incomes of ₹10,000–15,000, a two-week-plus income interruption represents a loss equivalent to half a month's income, with no mechanism to recover it. Heatwave was the primary climate driver of business disruption, cited by 80.7% of respondents, followed by heavy rainfall (71.3%) and unseasonal rain (53.3%). Flooding (47.3%), cyclones (24.7%), and drought (10%) also featured, underscoring that while heat is the dominant hazard, business disruption is often compounded by multiple simultaneous climate stressors.

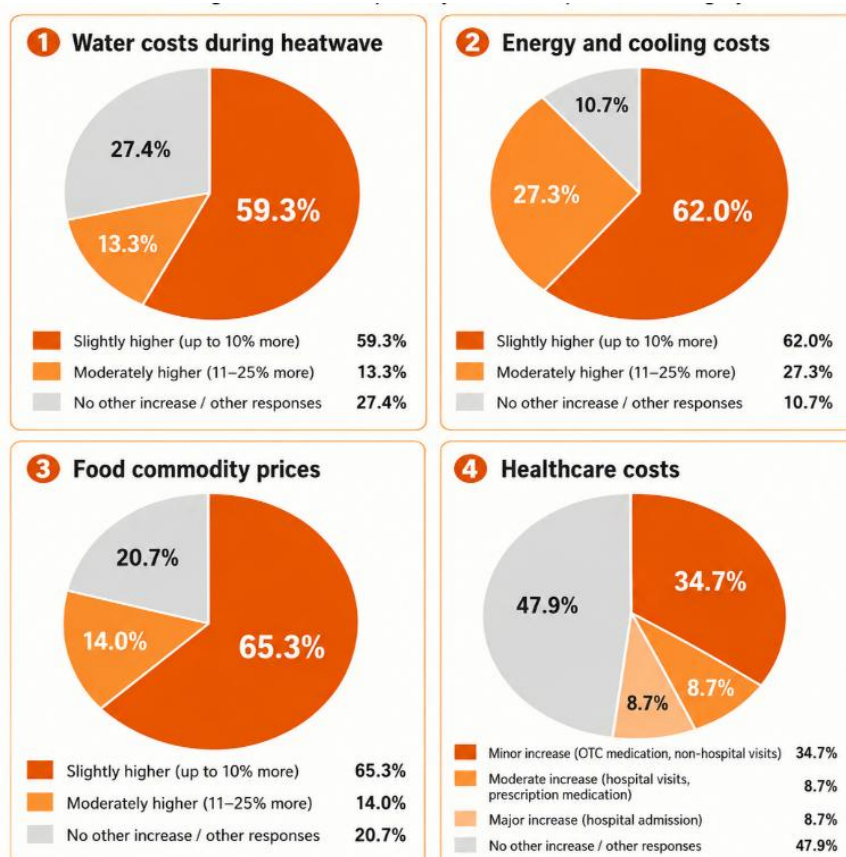
“Working during extreme heat is very difficult for me, and my health condition makes it even more challenging.” — Elsy A. C., Cochin.

When asked about the direct impact of the last extreme heat on their business, 47.3% said they felt 'somewhat concerned' but did not fully quantify their losses—a response that likely reflects both the normalisation of climate disruption and the absence of formal loss-reporting habits among small businesses. A further 19.3% explicitly reported reduced business and related opportunities, 14.7% experienced light business disruption, and 8% were forced to seek alternative business due to extreme heat, a finding that speaks directly to livelihood transformation under climate pressure.

Increased Household Expenditure

Income loss is only one dimension of the economic damage. Simultaneously, heat events drive up household expenditure across multiple domains, creating a double squeeze that rapidly

erodes the already thin margins of small businesses. The pattern of increased household expenditure during extreme heat is shown in following combined four charts.



Increased Household Expenditure Associated with Extreme Heat Among Small Business Households (N = 150). Figure 2 illustrates reported increases in water, energy and cooling, food, and healthcare expenditures during periods of extreme heat. Rising costs across these essential categories place additional financial pressure on small business households, compounding the direct income losses and livelihood impacts associated with heat-related disruptions. Together, these costs show how extreme heat affects both business continuity and household well-being.

Across all four expenditure domains—namely water, energy, healthcare, and food—the majority of respondents experienced cost increases during extreme heat. Critically, these increases occur precisely when income is declining due to reduced business activity, creating an asymmetric financial shock that disproportionately harms those with no savings buffer.

Service Disruption

Beyond direct expenditure increases, extreme heat disrupts the services on which small businesses depend. Power outages during heatwaves affected more than 80% of respondents: 52.21% experienced occasional outages (multiple short interruptions), and 44.85% experienced rare outages. For businesses that require refrigeration (fresh produce, meat, dairy), electricity-dependent equipment (tailors, cobblers), or cooling for workers and customers (food stalls, tea shops), a power outage is not an inconvenience; it is a direct cause of product spoilage and business closure.

Water availability was significantly disrupted. 59.29% reported noticeable reduction requiring conservation, 27.43% reported minor reduction, and 13.27% faced severe shortage. For fresh produce vendors, food and beverage sellers, and personal care service providers, water scarcity directly translates to business suspension.

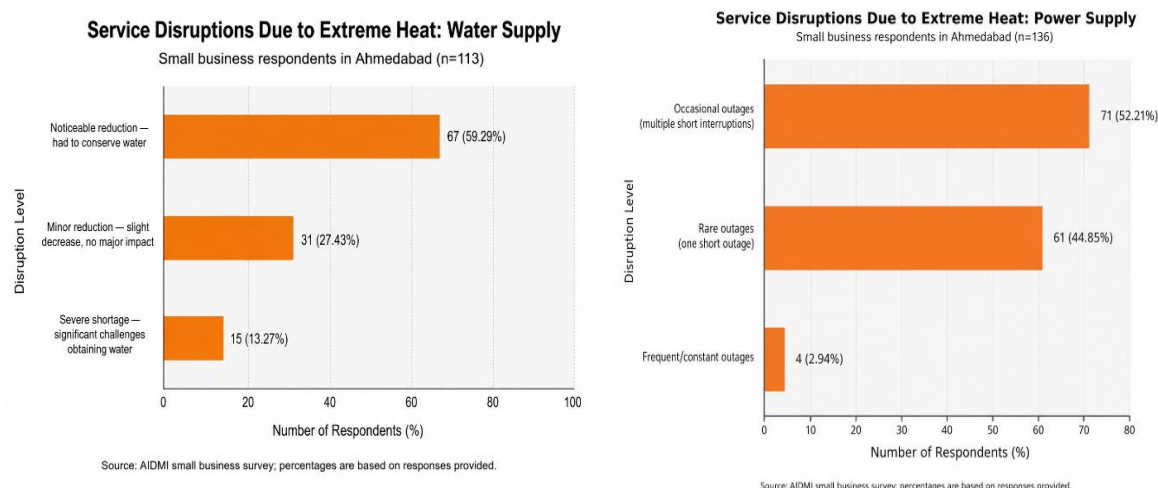


Figure 3: Service Disruptions Affecting Small Business Operations During Extreme Heat (N = 150). Reported power and water supply disruptions increased operational challenges for small businesses, contributing to spoilage, equipment downtime, reduced productivity, and business interruptions during periods of extreme heat.

Reported disruptions to power and water services, and their business impacts, are summarised in following charts.

Health Impacts: The Invisible Economic Loss

Health is both a direct form of loss and damage and an indirect amplifier of economic loss. When a business owner becomes ill, the business stops. When household members fall ill, the owner must divert time and money to caregiving and treatment. This study documents health impacts at a scale that demands policy attention.

More than half of all respondents (52.7%) reported heat-related illnesses, including heatstroke, heat exhaustion, and heat cramps, in their households in the past year. Water-borne diseases were reported by 8.7% of respondents, vector-borne diseases (malaria, dengue) by 5.3%, and respiratory issues from air pollution by 6.7%. Only 39.3% reported no illness at all.

Keeping Fish Fresh During Heat — Viji C. G., Cochin

Viji C. G., a fish seller in Ernakulam, faced direct livelihood losses during hot hours. Heat made fish spoil faster, increased smell, reduced customer footfall, and caused fatigue and headaches. She explained, “During the hot hours, it’s difficult to work with fish, the smell becomes stronger, and people don’t stop to buy.”

With resilience fund support, Viji purchased a second-hand refrigerator to store cleaned and unsold fish safely during peak heat hours. This reduced spoilage, lowered pressure to sell quickly, and improved business continuity. She said, “Now I don’t worry about fish getting spoiled quickly in the heat. I can work calmly, keep the fish fresh, and serve my customers better.”

Key lesson: Low-cost cooling and storage support can reduce loss and damage for perishable-goods businesses.

Mental health impacts were pervasive and systematically under-addressed. The data documents sleep-related disturbances (38%), increased stress (33.3%), difficulty concentrating (20.7%), and mood swings or irritability (18.7%). Anxiety or panic attacks were reported by 12% of respondents. These are not peripheral complaints for small business owners who depend entirely on their physical and cognitive capacity to trade; mental health degradation is a direct threat to livelihood continuity.

“When the heat is too much, customers stop coming and fruits spoil faster. On those days, it feels like all our hard work melts away in the sun.” — Ms. Surekha Patni, Ahmedabad.

The effect on daily activities was pervasive. Difficulty sleeping at night due to heat or humidity was reported by 62.7% of respondents. Reduced outdoor activities due to extreme heat or air pollution affected 56%, while 52% adjusted working hours to avoid peak heat. These behavioural adaptations represent a form of forced productivity loss that is invisible to economic measurement but real in its impact on household income.

4.4 Adaptation Effectiveness

One important research question of this study is whether adaptation measures meaningfully reduce loss and damage, or whether they merely redistribute and defer it. The findings present a complex picture. Adaptation is limited in scope, largely informal, and predominantly self-financed, but targeted external support demonstrably improves outcomes.

Current Adaptation Behaviour

The most common adaptive behavioural responses to extreme heat were staying indoors, reducing outdoor activity, and adjusting work schedules. In the survey, 56% of respondents reported reduced outdoor activities and 52% adjusted working hours to avoid peak heat. As this was a multiple-response question, these actions should be understood as overlapping coping strategies rather than separate categories. The available analysis identifies the most common measures adopted, but does not separately calculate how many respondents used only one measure compared with two or more measures.

These behavioural responses can reduce immediate health risks, but they may also reduce working time, customer engagement, and daily earnings. This highlights an important adaptation–loss trade-off: actions taken to protect health may still result in livelihood loss. In this sense, some forms of adaptation represent the management of unavoidable loss rather than the full prevention of loss.

In terms of home modifications for climate protection, the overwhelming finding is limited structural adaptation. Around 81.3% of respondents made no modifications to their homes. Among the 18.7% who did make modifications, the most common actions were elevating important belongings to protect against flooding (14%), improving

“With shade and water facilities, I can now run my business even in the afternoon. Heat affects my health less, and my income is better than during earlier summer days.” — Monu Saket, Rewa.

drainage (9.3%), and planting trees (6%). Structural, heat-specific modifications—such as cool roofing, reflective surfaces, and sealed windows—were adopted by fewer than 2% of respondents, indicating that such measures remain financially and practically difficult for many small business households.

Post-event investment was also constrained. Following the last extreme heat event, 90% of respondents did not make any new investment, citing financial constraints. Among the 10% who invested, reported actions included purchasing fans (8.7%), elevating houses or belongings (4.7%), and installing water storage systems (2%). This suggests that limited adaptation investment reflects resource constraints more than lack of awareness.

Financial Strategies for Managing Climate Loss

A striking three-quarters of respondents (76%) had not considered any financial strategy for managing climate-related losses. This is not indifference, but reflects the reality that formal financial products for climate risk are inaccessible to this population. Among those who had considered strategies, saving household income (18.7%), investing in preventive home measures (16.7%), and exploring microfinance options (10%) were the most cited approaches. Insurance uptake was negligible (8.7%), consistent with well-documented barriers of affordability, awareness, and product relevance.

The Resilience Fund: Evidence from Supported Businesses

The Resilience Fund²⁰ is a small-scale, targeted financial support mechanism that has reached more than 2,200 small businesses through AIDMI's wider extreme heat work. It is intended

Shade, Display, and Cooling for a Roadside Fruit Seller — Phulesha Jaiswara, Guwahati

Phulesha Jaiswara, a 48-year-old fruit seller near Guwahati's Bus Stand, supported a family of five through her roadside stall. Before receiving support, she sold fruit from plastic cartons placed on the ground, with no shade or proper protection. Heat exhaustion, fever, and headaches affected her ability to work, and every missed day meant income loss.

Support included a display rack, large umbrella, rechargeable fan, and protective covers. The rack improved customer trust, the umbrella provided shade, the fan reduced heat stress, and covers protected fruit from dust and sudden rain. These simple measures helped reduce spoilage, improve working conditions, and support more stable earnings.

Key lesson: Small micro-infrastructure can reduce heat exposure and improve business dignity, safety, and continuity.

²⁰ The Resilience Fund builds on AIDMI's earlier Livelihood Relief Fund, first developed after the Kandla cyclone in 1998, when AIDMI identified the need for timely support to small businesses for faster, safer, and more dignified recovery. The approach was later extended to disaster-affected poor families and small businesses after several disasters, including the 2001 Gujarat earthquake, 2004 tsunami in Tamil Nadu and Puducherry, 2005 Kashmir earthquake, Ladakh cloudburst, Sikkim earthquake, Bihar Kosi floods, Kumbhakonam fire tragedy, Ahmedabad floods, and floods and cyclones in Odisha. Over time, more than 30,000 disaster-affected families were supported through this fund

to help heat-affected small businesses adopt practical resilience measures and manage climate-related livelihood disruption. In this study, the Resilience Fund experience was combined with the 150-respondent loss and damage assessment to examine how financial support contributes to adaptation performance and business continuity.

“The fan, ceiling, stove, and exhaust make my workspace more workable. Snacks stay fresh, and customers keep coming.” — Ms. Suman Das, Guwahati.

Among the 150 respondents, several indicators were used to assess the use and perceived benefits of Resilience Fund support. These indicators came from different follow-up questions covering fund utilisation, implementation of resilience measures, improvement in working conditions, perceived contribution to business safety, overall helpfulness of the fund, and preparedness for future risks. The results show that 96.7% utilised the fund, 94.7% implemented climate resilience measures, 92.3% reported improved working conditions, 96% believed the support contributed to business safety, 72% found the funds “very helpful,” and 64.7% felt better prepared for future risks. These findings are based on respondent perceptions and self-reported experiences following support rather than independently measured impact indicators. Nevertheless, they provide useful insights into how small businesses view the value and relevance of resilience-focused financial support.

Among the 55 respondents who faced a climate event after receiving support, 80% said the support helped them cope significantly or somewhat. This suggests that accessible financial support can strengthen coping capacity and support practical adaptation among small businesses. These findings provide a useful basis for further impact studies to assess how far such support reduces quantifiable loss and damage over time, as discussed in Section 6.2.



Figure 4: Self-Reported Use and Perceived Benefits of Resilience Fund Support Among Small Businesses (N = 150). The figure presents respondent-reported outcomes following Resilience Fund support, including fund utilisation, implementation of resilience measures, improved working conditions, contribution to business safety, helpfulness of funds, and preparedness for future risks. The results reflect perceptions and experiences reported by respondents.

for safer and faster recovery. In 2023, AIDMI adapted this experience to support small businesses affected by extreme heat and established it as the Resilience Fund.

4.5 Limits to Adaptation and Residual Risk

Despite awareness of heat risk and some use of behavioural adaptation, the data show that meaningful structural and financial adaptation remains beyond the reach of many respondents. The limits to adaptation in this study are not mainly technical; they are financial, institutional, and systemic.

Ninety per cent of respondents made no post-event investment. Three-quarters had no financial strategy for managing climate-related losses. Only 20.7% received any government assistance at any point, and only 14% received livelihood support from any organisation. These figures point to a climate action and compensation gap: many small business owners continue to absorb heat-related losses through their own savings, reduced consumption, borrowing, or continued work under unsafe heat conditions.

Residual Risk and the Limits of Adaptation for Small Businesses Facing Extreme Heat. The figure shows how adaptation measures can reduce, but not fully eliminate, the impacts of extreme heat. Even after adopting behavioural, structural, or financial adaptation measures, many small businesses continue to experience income loss, health risks, rising costs, and operational disruptions. These remaining impacts represent residual risk and highlight the

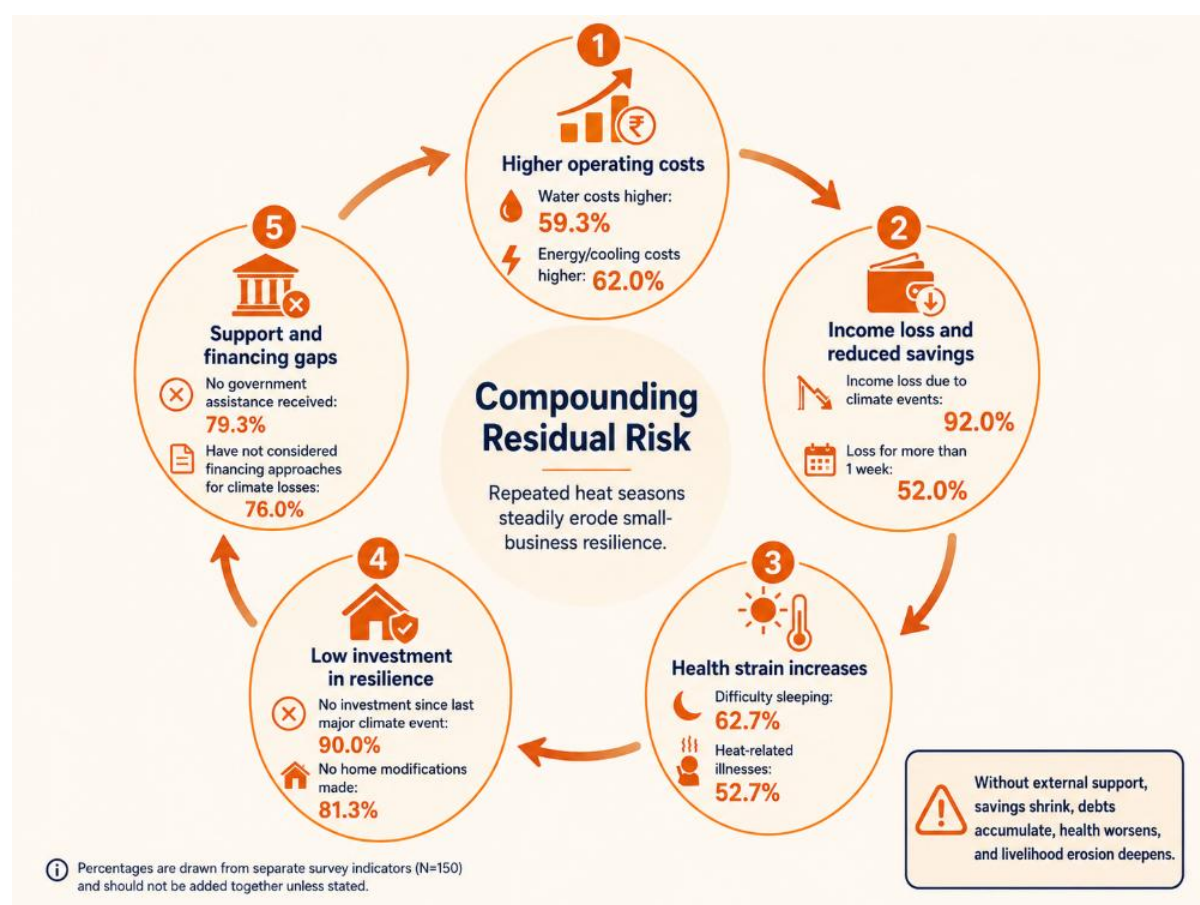


Figure 5: Residual Risk and the Limits of Adaptation for Small Businesses Facing Extreme Heat. The figure shows how repeated heat seasons can compound residual risk for small businesses through higher operating costs, income loss, health strain, low investment in resilience, and limited support or financing. It highlights that adaptation measures can reduce risk, but do not fully eliminate heat-related loss and damage, especially where small businesses lack timely finance, social protection, and institutional support.

need for additional support through social protection, climate finance, insurance, and loss and damage mechanisms.

Figure 5 shows how adaptation measures can reduce, but not fully eliminate, the impacts of extreme heat. Even after adopting behavioural, structural, or financial adaptation measures, many small businesses continue to experience income loss, health risks, rising costs, and operational disruptions. These remaining impacts represent residual risk and highlight the need for additional support through social protection, climate finance, insurance, and loss and damage mechanisms.

Residual risk is therefore compounding. Each heat season can leave at-risk businesses slightly more depleted, with reduced savings, rising debt, health stress, and weaker recovery capacity. The 8% of respondents who reported having to seek alternative business due to extreme heat illustrates an early sign of this livelihood pressure.

The findings also point to an opportunity to strengthen convergence between existing government assistance and heat-specific livelihood protection. Among respondents who received government assistance, support came through different sources, including MNREGA, PM-Kisan, and state livelihood initiatives. These schemes play an important role in supporting vulnerable households; however, they are not primarily designed to assess or compensate heat-induced income loss among small businesses. At the same time, the study shows that heat-specific adaptation remains limited, with 90% of respondents making no post-event investment and fewer than 2% adopting structural heat-specific measures such as cool roofing, reflective surfaces, or sealed windows. This indicates the need to complement



A small poultry keeper stands beside the shade structure created with the support provided. The shed helps reduce heat exposure for herself, protects the birds, and creates a more comfortable space for clients.

From Heat Stress to Stability — Nirmala Kewat, Rewa

Nirmala Kewat, a 35-year-old small business runner in Rewa, sells tea, snacks, and biscuits near Churahata Bypass. During peak heat hours, she experienced headaches, dizziness, and exhaustion. Heat also reduced customers and spoiled milk and snacks, creating direct financial loss. She said, “I often have to give up and go home early, losing money.”

With resilience fund support, she installed a shade sheet, water container, and battery-operated fan. These measures helped her continue working during afternoon hours, reduced health stress, and made the stall more comfortable for customers. She said, “With the fan, I can keep working even during the peak hours, and I don’t have to go home early anymore.”

Key lesson: Low-cost adaptation can reduce health stress, protect income, and support women vendors’ leadership in heat resilience.

existing social protection and livelihood programmes with heat-responsive measures, such as income-loss monitoring, timely cash support, cooling-related assistance, and links to Heat Action Plans. This would help ensure that small businesses affected by extreme heat can access support that is better aligned with their specific risks and recovery needs.

5. RECOMMENDATIONS FOR POLICY AND FINANCE

The findings of this study highlight several areas where policy, finance, and governance systems can be further strengthened to address heat-related loss and damage among small businesses. The recommendations presented below are informed by respondent experiences, field observations, and the gaps identified through the study framework, with particular attention to Heat Action Plans, loss and damage finance, and inclusive governance mechanisms.

5.1 Inclusive Heat Action Plans

India’s Heat Action Plans, pioneered by Ahmedabad and progressively adopted by cities across the country, have achieved significant mortality reductions. This study’s evidence, however, demonstrates that the economic dimension of extreme heat—particularly as experienced by small businesses—remains outside the scope of these plans. The findings also suggest that Heat Action Plans need to recognise differentiated livelihood risks among at-risk groups and business types, including women-led enterprises, older workers, persons with disabilities, low-income households, outdoor vendors, and businesses dealing with perishable goods. The following reforms are recommended.



A banana vendor operates a roadside stall in an open market. Extreme heat is damaging perishable goods, reduce customer footfall, and increase the risk of income loss for small businesses.

- **Integrate Economic Loss Monitoring into HAPs:** City-level HAPs should establish real-time income loss monitoring mechanisms during heat seasons, partnering with municipal markets, traders' associations, and Non-Governmental Organisations (NGOs) such as AIDMI to capture weekly income disruption data. This data should trigger graduated response protocols—not only health advisories, but direct economic protection activations.
- **Designate Heat-Resilient Business Zones:** Urban planning authorities should identify and designate 'heat-resilient business zones' in markets with high concentrations of small businesses, providing shaded infrastructure, misting systems, heat-linked insurance, safe drinking water, and cooling rest areas as public goods rather than leaving cooling to individual self-financing.
- **Extend HAP Communication to Informal Channels:** Given that 24.7% of respondents receive no climate advisory information at all, and that the most common channel is television (58%), HAP communication strategies must diversify to reach small businesses where they are. Community text alert systems, which already reach 42% of

respondents, offer a scalable channel for localised, actionable heat advisories—particularly for early market closures, product storage guidance, and emergency service access.

5.2 Loss and Damage Finance Mechanisms

The finance gap documented in this study is not a marginal problem. It is the central structural barrier to resilience for people in informal economy. The following financial instruments are recommended, calibrated to community-expressed demand.

- **Anticipatory Finance and Pre-Season Micro-Grants:** Respondents overwhelmingly prioritise immediate financial assistance (56.7% cited it as the most pressing need after disasters) and comprehensive compensation covering hospitalisation, lost income, and property damage (52%). Anticipatory finance mechanisms—pre-positioned cash transfers that are released when meteorological thresholds are crossed—can provide income support before loss occurs rather than attempting to compensate after. AIDMI's Resilience Fund pilot demonstrates that respondents use such funds effectively: 96.7% utilisation with demonstrated resilience outcomes.
- **Microfinance and Community Savings Expansion:** Microfinance was identified by 70% of respondents as a preferred low-cost financing mechanism, while subsidised loans and community grants were also seen as useful options. This indicates scope to strengthen links between small businesses, microfinance institutions, self-help groups, and community-based savings mechanisms. Financial support could be made more heat-responsive through flexible repayment schedules during peak heat periods, simplified access for low-income households, and faster disbursement when heat alerts indicate likely livelihood disruption. Community savings and credit groups can also play an important role in preparedness, recovery, and locally managed risk financing.
- **Index-Based Climate Insurance:** Insurance penetration among this population is negligible. Product development for index-based weather insurance—where payouts are triggered automatically by temperature or rainfall indices rather than requiring individual loss claims—can overcome the affordability and accessibility barriers that prevent take-up of conventional insurance. Premium subsidies, currently preferred by 5.3% of respondents as a policy measure, should be paired with simplified product design and community-level enrolment through Self-Help Groups (SHGs) and traders' associations.

5.3 Governance

Governance reforms must bridge the gap between international climate finance commitments and the micro-level realities of at-risk populations such as small business owners. Three governance-level recommendations follow from the study's findings (refer to table 4).

- **Strengthen and Harmonise Recognition of Extreme Heat in Disaster Governance:** Several Indian states have begun recognising heatwaves as a state-specific or local disaster, including Tamil Nadu and Madhya Pradesh. This is an important policy development that can enable relief support and strengthen public response to extreme heat. The next step is to harmonise such recognition across states and ensure that heat-related livelihood loss, especially among informal small businesses, is included in disaster response, compensation, insurance, and social protection mechanisms. NDMA heat guidelines and state Heat Action Plans can be further strengthened by adding economic loss assessment, livelihood continuity support, and clear protocols for vulnerable small businesses.
- **Establish Inclusive L&D Governance Mechanisms:** Social security and protection systems must be adapted to recognise climate-induced livelihood disruption. Respondents most strongly support establishing multi-hazard insurance covering healthcare, loss of work, and income (52.7%) and implementing government initiatives to subsidise multi-hazard insurance (52.7%). A tiered support system based on vulnerability assessments—integrating BPL status, gender, housing type, and business category—would ensure that support reaches those with the greatest residual risk.
- **Connect Community Evidence to UNFCCC L&D Mechanisms:** The UNFCCC Loss and Damage Fund, operationalised at COP28, must be accessible to communities and organisations working at the sub-national level.²¹

Three Domains of Policy Reform		
Inclusive Heat Action Plans	Loss & Damage Finance Mechanisms	Governance Reforms
• Integrate economic loss monitoring into HAPs • Designate heat-resilient business zones • Extend HAP communication to informal channels	• Anticipatory finance & pre-season micro-grants • Microfinance & community savings expansion • Index-based climate insurance products	• Strengthen recognition of heat-related livelihood loss in disaster governance • Establish inclusive L&D governance • Connect community evidence to UNFCCC mechanisms

Table 4: Three Domains of Policy Reform — Recommendations for Heat Action Plans, Finance, and Governance.

²¹ UNFCCC. (2023). Decision 5/CMA.4 – Operationalization of the New Funding Arrangements, including a Fund, for Responding to Loss and Damage Referred to in Paragraphs 2–3 of Decisions 2/CP.27 and 2/CMA.4 (COP28). United Nations Framework Convention on Climate Change. <https://unfccc.int/topics/adaptation-and-resilience/workstreams/loss-and-damage>

5.4 For *Duryog Nivaran*

Duryog Nivaran has, since its inception, played an important role in advancing alternative perspectives on disaster risk, vulnerability, and community-led resilience in South Asia. This study offers an opportunity to extend that tradition into the emerging field of extreme heat and loss and damage. The Resilience Fund can be further supported as a practical mechanism that not only reduces immediate heat-related stress among small businesses, but also generates grounded evidence on how affected communities understand, measure, and respond to loss and damage.

Duryog Nivaran may consider supporting the scaling and systematic tracking of this fund across additional locations and livelihood groups. Such an approach can help develop alternative, people-centred perspectives on loss and damage that are rooted in local experience, informal economies, gendered vulnerability, and community action. This learning can contribute to South Asian and global policy discussions by showing how small, timely, and locally managed finance can reduce avoidable loss and strengthen resilience before impacts become irreversible.

6. WAY FORWARD

This section outlines possible next steps for scaling the methodology, strengthening long-term evidence generation, and supporting policy engagement on heat-related loss and damage.

6.1 Scaling the Methodology

The approach used in this study—structured surveys, the framework, and disaggregated analysis by gender, BPL status, and business type—is designed to be replicable. It is recommended to extend to additional climate-vulnerable contexts within the South Asia region, including:

- Coastal communities facing compound heat and flooding
- Agricultural small businesses facing heat and water stress
- Hill economy enterprises facing heat as a new and unfamiliar risk
- Additional Indian cities beyond the current five, prioritising Tier-2 and Tier-3 cities with weak HAP coverage

Sectoral extension is equally important. The current study focuses on urban small businesses. The same framework can and should be applied to agricultural smallholders, pastoral communities, and coastal fisherfolk—populations for whom heat is one of multiple compound climate stressors causing L&D. Comparative analysis across sectors will strengthen the evidence base for people-centred L&D policy.

6.2 Long-Term Monitoring

The primary methodological limitation of this study is its reliance on respondent recall of income loss and expenditure changes over the past year. The inception report flagged this as a 'limited recall accuracy' risk, and the findings confirm it—with some respondents unable or

unwilling to quantify losses precisely, and the survey cannot distinguish between losses from different climate events that occurred across the same season.

It is recommended to establish a panel monitoring mechanism across the five study cities. A cohort of 50 respondents per city (250 total) would be tracked over three consecutive heat seasons—2026, 2027, and 2028—through quarterly income and expenditure check-ins. This longitudinal data would enable cumulative loss assessment rather than single-season snapshots; before-and-after comparison for respondents who receive financial support or adaptation assistance; tracking of livelihood trajectories, whether businesses are growing, stagnating, or exiting; and early identification of tipping points where incremental loss becomes irreversible damage.

Digital tools and community enumerator networks offer low-cost mechanisms for sustaining longitudinal engagement with this population. The Resilience Fund sub-sample in this study demonstrates high engagement and strong data quality; this cohort provides a natural starting point for panel monitoring.

6.3 Advocacy and Policy Engagement

The policy and finance recommendations require active advocacy to move from evidence to action. The following steps are proposed and presented in table 5.

City Level

Study findings should be shared with heat action plan focal points for incorporating small business economic protection into HAP revision cycles. Ahmedabad, with its established HAP institutional infrastructure, represents the most immediate opportunity for piloting an economic loss monitoring and response protocol.

National Level

The study's typology of heat-induced L&D and its evidence on the limits of current adaptation can be presented to the concern authorities in the context of India's National Adaptation Plan. Advocacy should build on emerging state-level recognition of heatwaves as a disaster risk and focus on strengthening the inclusion of small business livelihood loss within disaster response protocols. The study will support dialogue on how NDMA guidelines, state Heat Action Plans, and social protection systems can better capture income loss, health costs, productivity decline, and adaptation needs among informal small businesses.

International Level

Study findings should be submitted to the UNFCCC Loss and Damage Fund's technical advisory processes and shared with the Santiago Network. AIDMI, through its southasiadisasters.net publication can use this evidence to contribute to the construction of a South Asian narrative on slow-onset heat L&D that is grounded in informal economy realities rather than macroeconomic aggregates.

Proposed Action Roadmap: 2026–2028		
Phase 1 2026	Phase 2 2027	Phase 3 2028
1. Share findings with HAP focal points in all 5 cities 2. Submit evidence to NDMA and Ministry of Environment, Forest and Climate Change (MoEFCC) 3. Begin panel monitoring (50 respondents/city)	1. Pilot economic loss monitoring protocol in Ahmedabad 2. Develop heat-specific microfinance products with Microfinance Institutions (MFIs) 3. Submit evidence to UNFCCC L&D Fund advisory processes	1. Publish longitudinal income loss assessment (3-season) 2. Advocate for harmonised heat governance and livelihood loss compensation 3. Participate in COP regional L&D dialogues 2026–27

Table 5: Proposed Action Roadmap 2026–2028 — Phased Plan for Advocacy, Monitoring, and Policy Engagement.

ANNEX 1: CITY-WISE COMPARISON OF DATA

The following table provides a comprehensive city-wise comparison of all key loss and damage indicators across the five study sites (N=150).

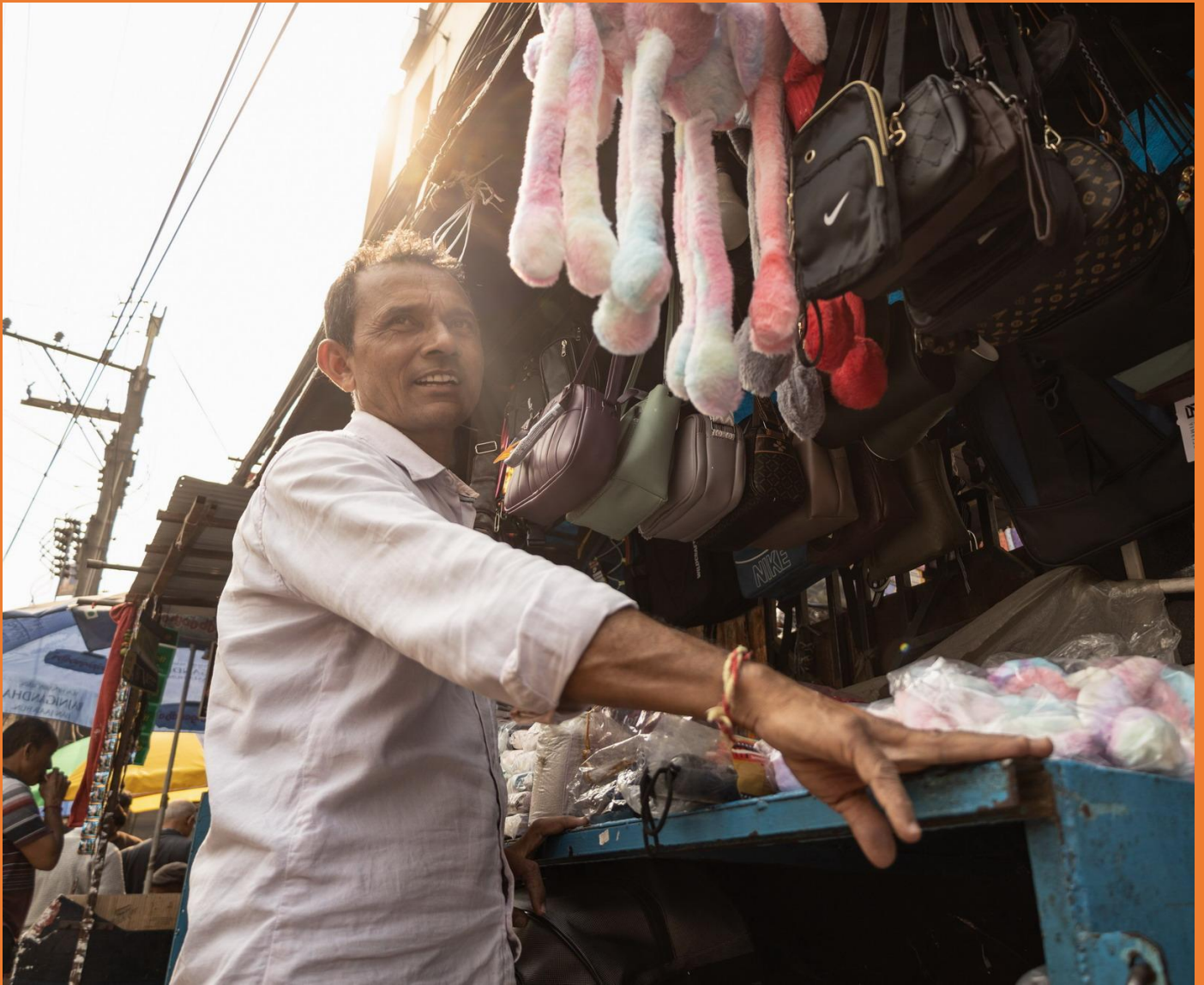
Indicator	Ahmedabad (Gujarat)	Guwahati (Assam)	Kolkata (W.B.)	Rewa (M.P.)	Cochin (Kerala)	Total
POPULATION PROFILE						
Respondents (n)	30	30	30	30	30	150
Female respondents	70.0%	36.7%	73.3%	83.3%	76.7%	68.0%
Below Poverty Line	0%	56.7%	26.7%	96.7%	100.0%	56.0%
Primary/No education	73.3%	43.3%	40.0%	80.0%	30.0%	75.3%
Kutcha housing	63.3%	23.3%	20.0%	33.3%	16.7%	31.3%
INCOME LOSS						
Any income loss in past year	100.0%	100.0%	73.3%	86.7%	100.0%	95.3%
Income loss > 2 weeks	3.3%	70.0%	56.7%	0%	16.7%	29.3%
HEALTH IMPACTS						
Heat-related illnesses	76.7%	66.7%	26.7%	93.3%	0%	52.7%
Mental health challenges	83.3%	96.7%	70.0%	10.0%	0%	46.0%
Sleep disruption	63.3%	93.3%	73.3%	76.7%	100.0%	62.7%
BUSINESS DISRUPTION						
Heatwave as main disruptor	100.0%	100.0%	100.0%	100.0%	3.3%	80.7%
Reduced / lost business	20.0%	30.0%	26.7%	6.7%	53.3%	27.3%

Indicator	Ahmedabad (Gujarat)	Guwahati (Assam)	Kolkata (W.B.)	Rewa (M.P.)	Cochin (Kerala)	Total
HOUSEHOLD EXPENDITURE						
Water costs increased	80.0%	100.0%	70.0%	23.3%	100.0%	74.7%
Energy/cooling costs increased	83.3%	100.0%	100.0%	86.7%	100.0%	89.3%
Healthcare costs increased	90.0%	100.0%	63.3%	6.7%	0%	52.0%
ADAPTATION CAPACITY						
No post-event investment	100.0%	80.0%	80.0%	90.0%	100.0%	90.0%
No financial strategy for L&D	100.0%	0%	83.3%	96.7%	100.0%	76.0%
GOVERNANCE & SUPPORT						
Received govt assistance	0%	13.3%	56.7%	33.3%	0%	20.7%
Received livelihood support	0%	6.7%	30.0%	33.3%	0%	14.0%

ANNEX 2: SURVEY INSTRUMENT OVERVIEW

The full questionnaire was deployed via KoboToolbox (Form ID: aNz7DmPs7ocq7EZfhbsvPG). The instrument covered nine thematic modules:

- Module 1: General Information (Demographics, business type, housing, income)
- Module 2: Impact on Health (Climate-related illness, mental health, daily activity disruption)
- Module 3: Impact on Livelihood (Climate event disruptions, business impact, income loss)
- Module 4: Impact on Household Expenditure (Water, energy, healthcare costs)
- Module 5: Impact on Resources and Services (Power, water availability, food prices)
- Module 6: Anticipatory Actions (Information sources, behavioural adjustments, home modifications, investments, financing approaches)
- Module 7: Recovery Support (Compensation preferences, financing mechanisms, social security preferences, pressing needs)
- Module 8: Support Needs (Business resilience needs, government assistance, livelihood support, BPL status)
- Module 9: Follow-Up on Resilience Fund (Utilisation, resilience measures, working condition improvement, disaster coping, preparedness, overall helpfulness)



A small-business owner sells bags and soft goods at a crowded outdoor market. Heatwaves is directly affecting by reduction in sales, shorten business hours, and expose to health risks as they work without adequate cooling or shade.

For more information:

Email: support@aidmi.org

Website: www.aidmi.org