Developing a Climate Vulnerability Index for under-Served Population in Peshawar: Evidence for Inclusive Policy Response

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EXECUTIVE SUMMARY

This study aims to develop a composite Socioeconomic Vulnerability Index (SeVI) keeping in view the socioeconomic vulnerability of Afghan refugee households residing in urban Peshawar. While focusing on the impacts of climate-induced stressors and the community's adaptive capacity, it quantifies vulnerability across key dimensions, including housing, income, health, education, and access to essential services. The sample data has been collected through a structured questionnaire of 118 refugee households. A non-probability convenience sampling method has been adopted to cover the under-served areas of rural Peshawar.

The study findings indicate that most of the households possess a high level of vulnerability across the selected sample, and no households fall inthe "Low Vulnerability" category. About 47.5% of households are categorized as moderately vulnerable, and 52.5% are highly vulnerable. Regression analyses identify household size, age of household head, years of residence, gender composition, and access to safe drinking water sources as significant determinants of vulnerability. Secure access to piped or borehole water and stable income sources are associated with reduced vulnerability whereas larger household size and seasonal income dependence heighten exposure and sensitivity to climate risks. While performing the gendered analysis, it was observed that both the number of female members and the presence of female-led income significantly influence household vulnerability. This increases the need for gender-responsive climate adaptation strategies. A thematic review of the KP Climate Change Policy (2022) and Climate Action Plan reveals that both the policy and plan give strong attention to mitigation but there is a limited operational focus on inclusivity and refugee-specific needs. Complementary stakeholder mapping along with SMART evaluation highlights the importance of multi-sectoral coordination and accountability in policy implementation.

Based on the findings and analysis, the study recommends targeted policy measures that directly address the daily challenges faced by Afghan refugee households in Peshawar. These measures include upgradation of housing in vulnerable settlements, access to safe drinking water, and support to small-scale businesses to reduce dependence on seasonal income. Gender-sensitive planning should prioritize opportunities for women-led livelihoods and improved access to healthcare and education for girls. To make these efforts effective, government agencies, humanitarian organizations, and refugee authorities must coordinate closely, with clearcut accountability mechanisms so that climate resilience is not considered just a policy goal, but a tangible improvement in the lives of refugee families.

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1. INTRODUCTION

1.1 BACKGROUND AND CONTEXT

In Pakistan, cities are experiencing the strain of climate change with heatwaves, floods, and water shortages becoming part of everyday life. These pressures are magnified by weak infrastructure, informal housing, and the sheer complexity of population. Peshawar, a crowded and fast-growing city, is the biggest example of it where Afghan refugees, in particular, bear the brunt. Many of these refugees live in under-served neighbourhoods where clean water as well as healthcare and other basic services are scarce. After decades of displacement, their struggles remain largely overlooked in climate vulnerability, gender planning, and urban policy, leaving them invisible in decisions that shape resilience and survival.

1.2 PROBLEM STATEMENT

In Pakistan, climate vulnerability studies are becoming more common, yet they rarely capture the realities of refugee communities. In particular, no study contributes to the development of a socio-economic vulnerability index (SeVI) for the Afghan refugees in Pakistan. Afghan families living in Peshawar face multifaceted risks such as insecure housing, unstable work, and limited access to healthcare or education. Women and girls often carry a disproportionate load, i.e., caregiving, restricted mobility, and reliance on fragile coping strategies. The absence of localized, refugee-specific data limits the evidence base needed to design policies that may meaningfully include and protect under-served refugee populations in Peshawar. Forced displacement is an aspect that is largely absent from existing vulnerability frameworks. Therefore, this study contributes theoretically by advancing the methodological development of SeVI to account for forced displacement.

1.3 OBJECTIVES

This study aims to develop a socioeconomic climate vulnerability index (SeVI) as well as assess the climate-driven socioeconomic vulnerability of Afghan refugee households in Peshawar through a gender-inclusive lens. It further seeks to:

- construct a composite SeVI using the IPCC framework of exposure, sensitivity, and adaptive capacity,
- analyze gender-differentiated coping mechanisms and access to resources,
- evaluate the responsiveness of existing climate change policies and action plans to refugee-specific vulnerabilities.
- provide evidence-based recommendations for inclusive climate resilience planning.

1.4 SCOPE AND LIMITATIONS

This study looks specifically at Afghan refugee households living in Peshawar's urban and peri-urban areas. To keep the analysis focused, host communities and internally displaced persons (IDPs) were not included in the sample. Although the research relies on a solid index-based approach and direct household surveys, there are some limitations. Legal sensitivities such as the refugees' status and type of card they possess, may have led to low response rate. It is, in fact, an important dimension, but we missed that. Our sample is cross-sectional, and secondary data is not available, so this lack of temporal data makes it harder

to track how vulnerability changes over time. It would have been great to assess the KP government's actions through this temporal dimension, which this study lacks.

1.5 STRUCTURE OF STUDY

The study has been divided into seven sections. Section 1 provides the context and purpose, Section 2 carries out literature review focusing on refugee-specific climate risks. Section 3 outlines the methodology, including sampling design and construction of the SeVI. Questionnaire and data collection is excluded from this section, but it is available on demand, and the first author may be contacted for the questionnaire details and microdata. Section 4 presents preliminary findings from the household survey. Section 5 analyzes the policy landscape and stakeholder dynamics, followed by Section 6, which offers targeted policy recommendations. The study concludes with a summary of insights and directions for future research.

2. LITERATURE REVIEW

2.1 CONCEPTUALIZING VULNERABILITY

The concept of vulnerability has evolved from various disciplines, including disaster studies, geography, social sciences, and public health. In the context of climate change, it is widely accepted that vulnerability is a social construct. Political, economic, and institutional structures that limit an individual's capacity to cope with climate-induced hazards shape vulnerability (Adger & Kelly, 1999; Blaikie et al., 2004). On methodological context, the IPCC (2007) defines vulnerability as a function of exposure, sensitivity, and adaptive capacity, a triadic framework that has become foundational in climate vulnerability assessments and related research.

Recent IPCC assessments further emphasize that vulnerability is deeply intertwined with social inequality, marginalization, and governance failures, rather than being driven solely by biophysical risk (IPCC, 2014; IPCC, 2022). Despite this, existing vulnerability frameworks and index-based approaches have struggled to adequately operationalize conditions of forced displacement, legal precarity, and restricted access to services. These factors fundamentally shape the climate vulnerability of refugee populations. This gap is particularly evident in under-served urban areas, where socioeconomic and gendered dimensions of vulnerability intersect with displacement-related constraints.

Biswas and Nautiyal (2023) trace the idea of vulnerability from early structuralist models to more nuanced, multidimensional frameworks. They emphasize that vulnerability is not merely a consequence of environmental exposure, but it is deeply embedded in social systems that marginalize certain groups, including refugees. This framing is particularly relevant for Afghan refugees in Pakistan, whose legal invisibility and economic precarity amplify their susceptibility to climate stressors.

2.2 VULNERABILITY IN REFUGEE CONTEXTS

Refugee populations, especially those residing in under-served urban settlements, face unique vulnerabilities that are often overlooked in mainstream climate policy, particularly the Khyber Pakhtunkhwa climate change policy and the action plan are silent about this issue. Sahana et al. (2021) demonstrate how infrastructural deficits, poor health outcomes, and limited livelihood options contribute to heightened vulnerability in coastal communities. Although their study focuses on Sundarban Biosphere Reserve, the methodological approach

— using household-level data and composite indices — is highly applicable to urban refugee contexts like Peshawar.

Previous literature review underlines that refugee vulnerability is shaped not only by environmental risks but also by systemic exclusion from formal institutions, social protection mechanisms, and development planning (Wisner, 2016; Bankoff et al. 2013). Afghan refugees in Pakistan often lack access to basic services such as healthcare, education, and secure housing, which exacerbates their sensitivity to climate impacts.

2.3 INDEX-BASED APPROACHES

Quantitative, index-based methods dominate the field of vulnerability assessment. Biswas and Nautiyal (2023) reviewed 87 studies and found that composite indices are widely used to capture the multidimensional nature of socioeconomic vulnerability. These indices typically integrate indicators across domains such as income, health, housing, and access to services, offering a replicable framework for policy-oriented analysis.

Sahana et al. (2021) constructed a SeVI using the IPCC framework, combining exposure, sensitivity, and adaptive capacity indicators. Their use of spatial data and household surveys provides a model for assessing refugee vulnerability in Peshawar, where climate stressors such as heatwaves, flooding, and water scarcity intersect with social and economic deprivation. Their strategy, i.e. incorporation of spatial variations, is more advanced than what we have adopted; this is one of the limitations of our study because of the financial constraints. In fact, the household spatial coordinates are required to adopt their strategy.

2.4 GENDER AND MIGRATION DIMENSIONS

Gender and migration are critical axes of vulnerability. Women in refugee communities often face compounded risks due to caregiving responsibilities, restricted mobility, and exclusion from decision-making processes (Ayeb-Karlsson et al., 2019). Biswas and Nautiyal (2023) highlight that vulnerability varies across social groups and is influenced by factors such as gender, class, and ethnicity.

For Afghan refugees, gendered vulnerability is particularly acute. Female-headed households are more likely to experience food insecurity, poor health outcomes, and limited access to adaptation resources. The literature calls for gender-disaggregated data and inclusive governance frameworks to ensure that adaptation strategies reflect the lived realities of marginalized populations (Adger, 2006; Wisner, 2016).

2.5 GAPS IN EXISTING RESEARCH

Although research on climate vulnerability has expanded in recent years, the everyday realities of refugee communities remain largely absent from these discussions. National and provincial climate policies, including those in Pakistan, rarely acknowledge refugees as a distinct group, leaving their unique challenges invisible in planning frameworks. Scholars such as Biswas and Nautiyal (2023) call for new methods and stronger policy integration, while Sahana et al. (2021) highlight the need for locally grounded indicators and community participation.

The existing literature misses the assessments that capture the voices and experiences of refugees themselves. How do families navigate unsafe housing, irregular incomes, and limited access to healthcare and education? How are the existing policies implemented in the

refugee-dense areas? While socio-economic vulnerability indices have been widely applied to urban populations, these models rarely incorporate indicators relevant to forcibly displaced communities. Without this localized evidence, interventions risk overlooking those most at risk. Adapting existing models to include refugee-specific indicators would allow policymakers to design strategies that not only strengthen resilience in theory but also improve the daily lives of the refugee households facing climate stress.

3. METHODOLOGY

We employed a mixed-method approach to assess climate-driven socioeconomic vulnerability among Afghan refugee households in under-served areas of Peshawar. A composite socio-economic vulnerability index (SeVI) was developed using the Intergovernmental Panel on Climate Change (IPCC) framework. The framework basically conceptualizes vulnerability through three interlinked dimensions, i.e. exposure, sensitivity, and adaptive capacity. For the index development and related statistical analysis, primary data were collected through a structured household questionnaire designed to capture demographic, economic, infrastructural, health, and gender-specific indicators.

A total of 118 households were selected using a non-probability sampling. The sample size of 118 was determined based on feasibility, resource constraints, and the need to detect meaningful differences in vulnerability scores. Data were cleaned and analyzed using SPSS version 22. Composite scores were normalized to construct the SeVI.

In parallel with the empirical assessment, policy analysis was conducted to evaluate the responsiveness of existing climate policies to the needs of Afghan refugees and other vulnerable groups such as women and children. The analysis focused on the Khyber Pakhtunkhwa Climate Change Policy (2022) and its associated action plan. In this second part of the study, key dimensions included institutional accountability, gender responsiveness, financing mechanisms, and inclusion of displaced populations. Here, we look at the displaced population, which is broader than the refugee population, to make the analysis applicable to all displaced populations. Stakeholder mapping was employed to identify power-interest dynamics among various actors such as the Commissionerate for Afghan Refugees (CAR), Planning & Development Department (P&D), UN agencies, and local CSOs. Policy gaps were identified for the refugee populations by triangulating field data with policy provisions, revealing areas where refugee-specific vulnerabilities remain unaddressed. The findings informed a set of policy recommendations aimed at embedding refugee-sensitive and gender-inclusive strategies into provincial climate resilience planning.

3.1 DEVELOPMENT OF THE INDEX

The methodology related to the SeVI development consists of four sequential steps:

- variable selection and classification;
- data normalization;
- index construction; and
- disaggregation for contextual analysis.

The analyses were carried out in precise accord with the formulation given below:

$$Vulnerability = f(Exposure, Sensitivity, Adaptive\ Capacity)$$

In practice, exposure captures how frequently and intensely households are confronted by climate shocks. Sensitivity reflects the degree to which these hazards can derail daily life. Finally, adaptive capacity shows the very human strengths of foresight and solidarity, i.e. the ability to heed an early-warning siren to draw upon community networks, etc.

Based on the data acquired through the questionnaire, each indicator has been assigned to one of the three IPCC pillars:

- Exposure (E): for example, perceived changes in summer length and heatwave frequency, flood experience (binary), dust-storm exposure.
- Sensitivity (S): for example, housing quality (ordinal: Kutcha–Pucca), water and sanitation access (binary), income stability (binary), disability presence (binary).
- Adaptive Capacity (AC): for example, access to early-warning systems (binary), disaster assistance received (binary), household coping plans (binary), perception of government response (Likert).

Each indicator's theoretical link to vulnerability has been confirmed by IPCC AR4 (2007) and Livelihood Vulnerability Index (Hahn et al. 2009). Furthermore, the method utilized in this study incorporated conceptual advances from IPCC AR5 (2014) and IPCC AR6 (2022). Compound hazards and indicators that capture both resources and coping strategies, including potential maladaptive outcomes, were assessed. Similarly, socioeconomic and gender-differentiated factors were included to ensure that the SeVI reflects the complex, intersecting vulnerabilities experienced by Afghan refugee households. A detailed questionnaire map according to the IPCC pillars is given in Table 1.

3.1.1 DATA NORMALIZATION

To ensure comparability across diverse indicators, each raw response has been rescaled to lie between 0 and 1. Dichotomous items (e.g. Yes/No questions) have been coded as 1 for "Yes" and 0 for "No." Ordinal categories such as housing quality have been assigned fixed values (e.g. Kutcha = 0; Semi-Pucca = 0.5; Pucca = 1). Likert-type responses on a 1–5 scale are normalized by subtracting the minimum (1) and dividing by the range (5 – 1), yielding scores between 0 and 1.

$$x = \frac{x - 1}{5 - 1} \Rightarrow x \in [0,1]$$

Adaptive-capacity indicators are then reversed-scored (1 – normalized value) so that higher values consistently reflect greater vulnerability.

$$\tilde{a}_{\text{rev}} = 1 - a$$

For continuous measures such as age or income, a standard min–max transformation has been used:

$$x = \frac{x - min(x)}{max(x) - min(x)} \Rightarrow x \in [0,1]$$

3.1.2 COMPOSITE INDEX CONSTRUCTION

Based on Hahn et al. (2009), each sub-index will be computed as the unweighted average of its normalized indicators:

$$E = \frac{1}{n}\sum^{i=1} e_i \, , S = \frac{1}{m}\sum^{j=1} s_j \, , \mathrm{AC} = \frac{1}{k}\sum^{k=1} a_k$$

The overall SeVI for a household is then calculated as:

$$\mathrm{SeVI}_h = \frac{1}{3}(E_h + S_h + (1 - \mathrm{AC}_h))$$

Here, $e_i, s_j, a_k \in [0,1]$. and subtracting AC from 1 ensures that greater adaptive capacity lowers vulnerability (IPCC AR4, 2007; Hahn et al., 2009).

Equal weighting (w=1/3) is adopted as the default scheme to ensure transparency and remove the subjectivity bias. Thereafter, composite SeVI scores are then disaggregated by gender of the household head and other demographic categories, and t-tests will be applied to determine whether mean vulnerability differs significantly among these groups. Furthermore, generalized regression modeling will be employed to estimate the effects of such factors on SeVI scores and test their significance.

Table 1. Questionnaire Mapping to IPCC Pillars

Section	Question / Indicator	IPCC Pillar	Notes (Normalization / Use)
Household Identification & Demographics	Gender of Household Head	CTX	Used for gender-disaggregated analysis. Binary (M=0, F=1).
	Age of Household Head	CTX	Potential sensitivity factor; numeric normalization.
	Ethnicity	CTX	For socio-cultural analysis only.
	Household size & composition (0–14, 15–64, 65+)	CTX / S (optional)	Could increase sensitivity if high dependency ratio. Numeric normalization if used.
	Disabled household members	S	Binary (Yes=1). Indicates higher sensitivity.
	Years lived in area	CTX	Potential exposure factor for chronic risk.
	Documentation status (CNIC/PoR/ACC/None)	AC	Affects access to aid, legal protections. Ordinal coding.
Asset Ownership	Mobile phone	AC	Access to info/early warning. Binary.
	Fan/Cooler, Refrigerator	AC	Enhances coping with heat stress. Binary.
	Vehicle	AC	Evacuation mobility. Binary.

	Livestock	S	Livelihood sensitivity to hazards. Binary.
	Agricultural land	S	Sensitivity to climate events. Binary.
	Bank account	AC	Financial resilience. Binary.
	Solar panel	AC	Increases adaptive capacity. Binary.
	Generator/UPS	AC	Backup during outages. Binary.
	Cooking stove type (Gas/Wood/Electric)	S	Proxy for energy vulnerability. Ordinal coding.
Housing, Water & Infrastructure	Housing type (Kutcha/Semi/Pucca)	S	Ordinal (0–0.5–1).
	House ownership	S	Renting may increase sensitivity. Binary.
	Number of rooms	S	Crowding index (normalized).
	Electricity, Bathroom, Toilet, Kitchen access	S	Binary. Essential services.
	Main water source & availability (hrs/day)	S	Binary or numeric. Lower availability = higher sensitivity.
	Distance to school & health facility	S	Numeric, normalized. Access to services = lower sensitivity.
	Paved road access	AC	Facilitates evacuation/support access. Binary.
	Energy-efficient street lights	AC	Proxy for public infrastructure quality. Binary.
Livelihood & Income	Annual income sources (Agriculture/Labor/etc.)	S	Economic dependence on climate-sensitive sectors. Normalized shares.
	Female-led income / women earning	AC	Gender empowerment improves adaptation. Binary.
	Seasonal income	S	Instability increases sensitivity. Binary.
	Income loss due to climate in last 5 years	E	Past exposure to climate impact. Binary.
	No. of earners	AC	More earners = stronger coping. Normalized.

Climate Perceptions (1–5 Likert)	Summers longer, rainfall erratic, floods frequent, water decline, food prices up, air quality worsening	E	Perceived exposure to climate change. Normalized Likert scale.
Exposure to Climate Events	Flood, heatwave, dust storm, livelihood loss, relocation, fog/smog events – frequency & impact	E	Event occurrence (binary), frequency (normalized), impact (1–3 scale normalized).
Health Impact	Diarrhoea, dehydration, skin disease, heatstroke, respiratory issues, dengue, malaria, stress	S	1–3 scale normalized.
	Barriers to healthcare (documentation, cost, distance, discrimination)	S / AC	Sensitivity increases if barriers exist; AC reduces if access exists. Binary coding per barrier.
Education Disruption	Climate affected schooling (Y/N), effect type, girls vs. boys affected, school damage, online learning availability	S	Binary or ordinal coding.
Coping Mechanisms	Borrowing, asset selling, skipped meals, migration for work, children pulled from school, informal labour	AC	Binary per strategy. Negative coping = lower AC score.
	Increased dependence on aid	S	Indicates vulnerability persistence. Binary.
Support Systems & Adaptation	Early warnings received, behaviour change, help from Govt/NGO, trust in warnings, community group membership, knowledge of contacts, barriers due to refugee status	AC	Binary coding. Lack of access reduces AC.
Adaptation Actions Taken	House foundation raised, shade planted, small business started, relocation, solar energy adoption, restriction due to ownership, org support received	AC	Binary coding. More actions = higher AC.

	Priority support needed in future emergencies (multiple choice)	CTX	Qualitative/contextual insights only.

Index: Exposure Indicators (E), Sensitivity Indicators (S), Adaptive Capacity (AC), Contextual (CTX)

3.2 STATISTICAL TOOLS

The primary data for this study was collected through structured face-to-face interviews using a detailed questionnaire tailored to the climate vulnerability context of Peshawar. Following data collection, responses were digitized and processed by using SPSS and R studio interchangeably. Initial data cleaning involved consistency checks and validation of entries, after which missing values were addressed using multiple imputation techniques to preserve the integrity and representativeness of the dataset.

Descriptive statistical methods were employed to summarize and explore the characteristics of the sampled population. Categorical variables — such as housing type, documentation status, coping mechanisms, and access to climate adaptation infrastructure — were analyzed using frequency distributions, percentages, and visualized through pie-charts and bar graphs. For continuous variables like age, household income, and years of residence, measures of central tendency (mean) and dispersion (standard deviation) were computed to understand the distribution and variability across groups.

To quantify household-level vulnerability, a SeVI was constructed using a composite scoring methodology. This involved standardizing selected indicators across dimensions such as exposure, sensitivity, and adaptive capacity, and computing the index using SPSS's 'Compute Variable' function. The SeVI scores were then used as the primary outcome variable for further inferential and descriptive analysis.

To assess the statistical significance of differences in vulnerability across subgroups, i.e. particularly between male- and female-headed households, etc. Additionally, multiple linear regression models were applied to identify key predictors of SeVI, including demographic, economic, and climate perception variables. These models helped isolate the influence of gender and access to adaptation resources on household vulnerability while controlling for potential confounders.

3.3 Ethical consideration

This study strictly adhered to international and institutional ethical guidelines for research on human subjects.

- All participants were provided with an information sheet explaining the study objectives and procedures, prior to data collection.
- Informed consent was obtained from all participants with verbal consent documented for those with literacy challenges.
- Participants were informed of their right to decline or withdraw at any stage without consequence.
- All personal identifiers were removed during data entry, and anonymized datasets were stored. The data was only accessible to the research team.

4. DISCUSSION AND ANALYSIS

4.1 DEMOGRAPHICS

The age of the household head ranged from 11-105 years (mean = 47±15.18). The minimum value reflected cases where adolescents were heads of the household. This may be linked to the displacement-related family disruptions.

The average number of persons in the household was 7.4 members (SD = 3.74). The relatively large family units are consistent with refugee families, where extended families often live together. Age-wise, 2.6 members per household were children (aged 0–14 years). The high dependency ratio may therefore exacerbate vulnerability to climate change (Table 2). Furthermore, a large majority of households (78.8%) were headed by men, while the rest (21.2%) were headed by women. The presence of a considerable share of women heading households is notable within the refugee population. Such households may face compounded socioeconomic disadvantages, including limited income-generating opportunities and constrained access to adaptation resources. These patterns indicated structural vulnerabilities that intersect with gender and household composition, which may influence the overall socioeconomic resilience of the communities in question.

Table 2. Descriptive Statistics of Key Demographic Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age of Household Head (years)	118	11	105	47.07	15.18
Total Household Members	118	2	30	7.40	3.74
Members aged 0–14 years	94	0	8	2.62	1.83

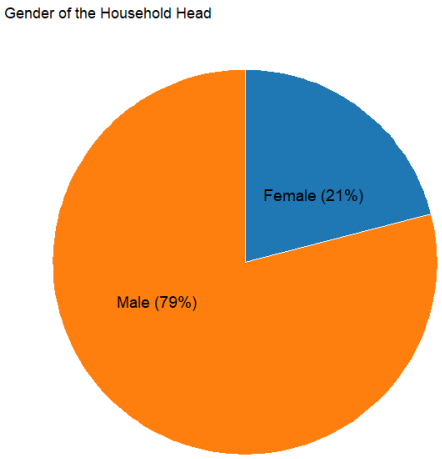

Figure 1. Gender distribution of the household head

4.2 ASSET OWNERSHIP

Asset ownership patterns reveal a mixed profile of material well-being and economic vulnerability (Table 3). Mobile phones, fans or coolers, and refrigerators were owned by 99%, 91.5%, and 77.1% of the respondents, respectively. Similarly, televisions, driving licenses, and vehicles were reported by 61.9%, 73.7% and 65.3% respectively.

Generators/UPS/Inverters and Solar panels' ownership remained marginal, as only 44% of the respondents reported it during the survey. A very small fraction (16.9%) of the community members should have ownership of bank accounts. The high ownership of communication tools, such as television and mobile phones' widespread access to early warning information or connectivity during emergencies. Similarly, the high ownership of fans or coolers and refrigerators may indicate adaptation to rising summer temperatures.

Nearly all households reported owning a mobile phone (99.2%), suggesting widespread access to communication tools — an essential component for receiving early warning information or staying connected during emergencies. Similarly, high ownership of fans or coolers (91.5%) reflects adaptation to rising summer temperatures in urban Peshawar.

However, ownership of financial and energy-resilient assets remains limited, indicating restricted access to formal financial systems, savings, and credit facilities that are critical for climate adaptation. Limited ownership of solar panels or generators reflected partial but uneven access to alternative energy sources.

The relatively high ownership of certain assets, such as vehicles, etc. may indicate that some refugee households have achieved moderate urban integration. However, this should not obscure underlying income insecurity and informal employment conditions. The coexistence of asset ownership with financial exclusion emphasizes a form of *"non-liquid resilience*". Material assets may exist, but do not necessarily translate into adaptive capacity against climate-induced risks. Material possession alone may not safeguard refugee populations from climate stress when institutional and financial support remain weak.

Table 3. Household Asset Possession among Afghan Refugee Households (N = 118)

Asset Type	Frequency	Percentage of Households Owning Asset
Mobile phone	117	99.2
Fan or cooler	108	91.5
Television	73	61.9
Refrigerator	91	77.1
Vehicle (motorcycle or car)	77	65.3
Livestock	81	68.6
Agricultural land	90	76.3
Bank account	20	16.9
Solar panel	52	44.1
Driving license	87	73.7
Generator / UPS / Inverter	53	44.9

4.3 HOUSING AND INFRASTRUCTURE

Approximately, half of the respondents (54.2%) lived in pucca housing, while the other half, 28.8% and 16.9% availed semi-pucca and kutcha structures respectively. Notably, only 23% were the owners of the houses they were living in (Table 4). Housing showed high heterogeneity among the refugee population and suggested potential for high vulnerability

among the sections living in semi-pucca and kutcha housing. The small fraction of ownership showed high residential insecurity along with limited ability to invest in housing improvements.

Most households reported having access to electricity (95.8%), bathrooms (92.4%), toilets (95.8%), kitchens (84.6%), and paved roads (81.2%). However, the distribution was uneven across the area (Table 4). Despite the availability of basic utilities, the quality and security of housing were critical dimensions of socioeconomic vulnerability in the refugee population.

Table 4. Housing and Basic Infrastructure Characteristics of Refugee Households

Variable	Category	Count	Percentage of Households
Type of house	Pucca (permanent)	64	54.2
	Semi-pucca (semi-permanent)	34	28.8
	Kutcha (temporary)	20	16.9
Owns the dwelling	Yes	27	23.1
	No (rented/temporary)	90	76.9
Access to electricity	Yes	113	95.8
	No	5	4.2
Access to bathroom	Yes	109	92.4
	No	9	7.6
Access to toilet	Yes	113	95.8
	No	5	4.2
Access to kitchen	Yes	99	84.6
	No	18	15.4
Road paved	Yes	95	81.2
	No	22	18.8
Energy-efficient streetlights available	Yes	53	44.9
	No	65	55.1

4.4 LIVELIHOOD AND INCOME

The income and occupational profile indicate a concentration in low to moderate-income and informal employment sectors (Table 5). The two dominant livelihood groups were business/trade (39%) and labour-based work (38%), followed by agriculture (17.8%) and a small fraction in teaching in private school employment (5%).

The monthly income ranged widely (PKR 21,000–3,000,000) with a mean of PKR 238,000, and a median of PKR 90,000, revealing high disparity across the households. A small segment of the respondents was engaged in better-paying commercial activities, hence the inflated mean. However, the majority of the respondents subsist near the lower income spectrum.

In general, each household had two income earners, suggesting shared financial responsibility but also potential vulnerability if one source is disrupted.

Moreover, income loss due to climate-related events in the past five years was reported by 66% of households. This finding divulges the dependence of refugee livelihoods on weather-sensitive informal sectors, i.e. daily wage earners and small business operators.

Table 5. Livelihood Profile and Income Characteristics of Refugee Households

Indicator	Category / Statistic	Value
Income Source	Labour (daily wage or unskilled)	45 (38.1%)
	Business / Trade	46 (39.0%)
	Agriculture	21 (17.8%)
	Teaching	6 (5.1%)
Mean monthly household income (PKR)		238,337
Median monthly household income (PKR)		90,000
Minimum – Maximum (PKR)	21,000 – 3,000,000	
Average number of income earners per household		2
Households reporting income loss due to climate-related events (past 5 years)	76 (66.1%)	

4.5 CLIMATE PERCEPTIONS AND EXPOSURE

Based on the climate perception data (Table 6), a high degree of climate awareness among the respondents was assessed. A substantial majority (86%) agreed or strongly agreed that summers are getting longer, while 58% observed that rainfall has become more erratic. Likewise, 71% reported a decline in water availability, while an overwhelming 81% linked rising food prices to climate change. Regarding environmental conditions, 64% of households agreed that air quality is worsening, a perception aligned with increasing vehicular emissions and unregulated urban expansion. Despite varying views on flood frequency, over half of respondents (52.5%) reported high flood impact.

Among the climate-induced natural hazards (Table 7), heatwaves, dust storms, and flooding emerged as the most severe hazards. Nearly 70% experienced high heatwave impact, 59% reported severe dust storm effects, and over half faced high flood-related losses. Pronounced Livelihood disruption was reported, with almost 40% classifying its impact as high, reflecting dependency on daily wage or small-scale business income. A small fraction reported relocation as the pronounced impact they experienced. Nonetheless, most of these movements were either short-term or seasonal. Yet, they suggest a limited adaptive capacity of the respondents. Further, a clear perception–exposure convergence could be deduced from these findings.

Table 6. Perceptions of Climate Change among Refugee Households (N = 118)

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Dominant Perception
Summers are getting longer	2	7	6	25	77	Strongly Agree

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Dominant Perception
Rainfall is more erratic	2	18	31	40	26	Agree
Floods are more frequent	19	26	25	17	30	Mixed
Water availability has declined	15	16	18	23	45	Strongly Agree
Climate change affects food prices	11	10	15	17	64	Strongly Agree
Air quality is worsening	21	10	22	25	39	Agree

Table 7. Frequency and Impact of Climate-Related Events

Event Type	Impact Level	Frequency (%)	Mean Frequency	Range
Flooding	Low 24.6 – Moderate 22.9 – High 52.5	High	4	1–20
Heatwaves	Low 9.3 – Moderate 21.2 – High 69.5	High	3	1–15
Dust storms	Low 13.6 – Moderate 27.1 – High 59.3	High	5	1–15
Livelihood loss due to climate events	Low 15.3 – Moderate 38.1 – High 39.8	High	2	0–15
Relocation due to hazards	Low 37.3 – Moderate 25.4 – High 18.6	Moderate	2	0–15
Fog and reduced visibility	Low 22.9 – Moderate 21.2 – High 51.7	High	3	1–10

4.6 HEALTH IMPACTS

Climatic stressors as well as the physical and psychological well-being of Afghan refugees were strongly linked (Figure 2). Mental stress and heat-related illnesses were the most prevalent issues. Heatstroke at moderate or severe levels was reported by more than 80% of households. Similarly, 62.5% reported severe stress or anxiety attributed to climate change, suggesting psychosocial distress. Among the waterborne and vector-borne diseases, half of households (50%) experienced moderate diarrhoeal impacts, while 42% reported moderate dehydration, both linked to declining water quality and availability.

Malaria (34.5% moderate, 25% severe) and dengue (28.7% moderate, 21.7% severe), the ongoing public health concerns, were frequently reported with moderate-severe impacts. Both diseases frequently cause health-based issues in dense settlements of Peshawar city, with poor sanitation and stagnant water. Respiratory problems (74.8%) and skin diseases (70.7%) were also reported, manifesting the highest impact and may be linked with the deteriorating air quality and dust storms.

The co-occurrence of multiple ailments in the area is a manifestation of the compound nature of vulnerability, whereby climatic, environmental, and social factors interact to exacerbate the health risks faced by marginalized communities.

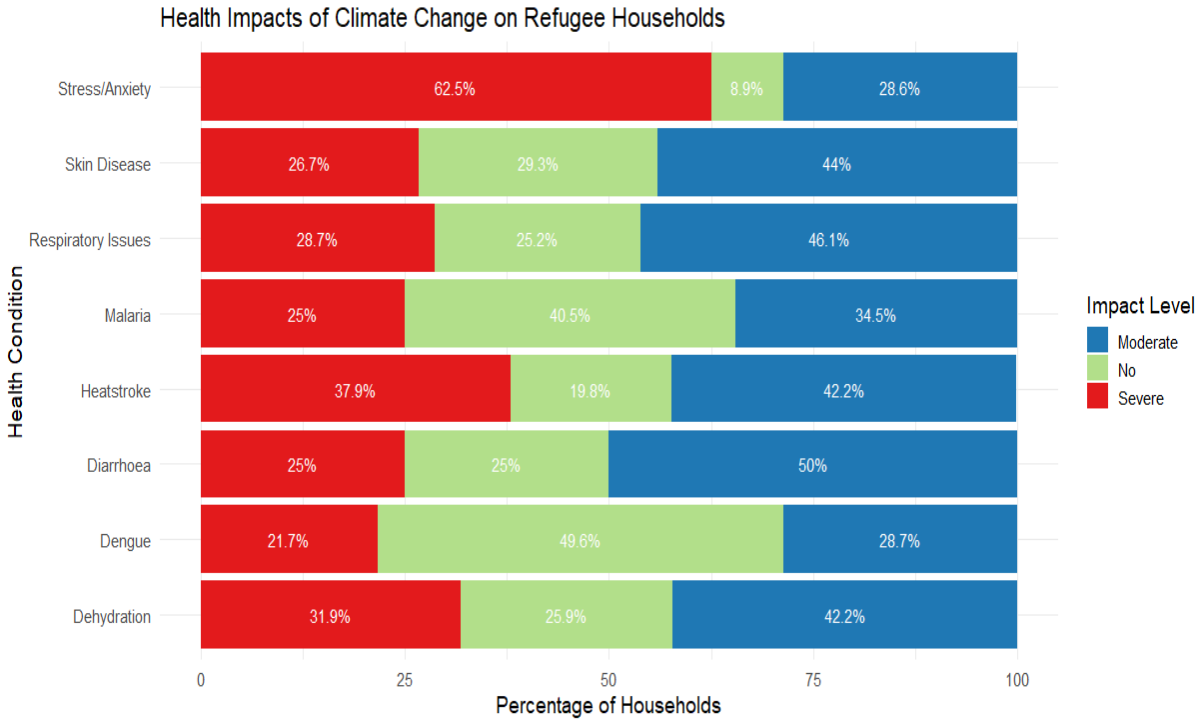

Figure 2. Self-Reported Health Impacts Attributed to Climate Conditions

4.7 COPING MECHANISMS AND SUPPORT SYSTEMS

The responses on coping behavior among Afghan refugee households reflected a high exposure to climate stress and limited institutional safety nets (Table 8). The most common financial coping mechanism was borrowing money (93%) from others. The mechanism is typically led by men (48%) or in some cases by spouses (35%) in all households. Similarly, 55% of households coped with climate stress by selling assets. This reliance on short-term measures eventually leads to erosion of future resilience. Food insecurity was widespread; 43% of households skipped meals among both male and female members. In response to economic and climate shocks 40% had withdrawn their children from schools to save money. These results suggest that capital development is heavily undermined by climate stress in refugee communities. Pronounced labor-based adaptation were reported (67%), these households sent male members to work elsewhere. Furthermore, 40% of the households engaged men in informal labor, while 10% reported involvement of women and children together. Such labor shifts suggest an attempt to adapt to climate stress through income diversification. However, such measures usually come with a cost of social stability and child welfare. An overwhelming majority (73%) reported increased reliance on humanitarian aid. However, only 34% received any early warning of the events. Television (72%) was the main channel of information, whereas mobile alerts (18%) and community systems (8%) were minimal. A communication gap therefore exists that hampers the reach of timely and actionable climate information.

Table 8. Household Coping Strategies and Support Systems

Coping Mechanism / Support	Primary Actor	% of Households	Key Observation
Borrowed money to cope with climate stress	Men	48.3	*Financial coping dominated by male members.*
	Women	10.3	
	Both	34.5	*Shared financial responsibility.*
	None	6.9	*Few had savings or external aid.*
Sold household assets	Men	35.3	*Asset liquidation as a short-term buffer.*
	Women	20.7	
	Both	34.5	
	None	9.5	
Skipped meals	Men	12.1	*Food insecurity widely shared within families.*
	Women	6.0	
	Both	43.1	
	None	38.8	
Sent family member to work elsewhere	Men	67.0	*Labour migration as key survival response*
	Women	8.7	
	Both	21.7	
	None	2.6	
Withdrew children from school	Men	29.8	*Education loss linked to economic distress*
	Women	9.6	
	Both	21.1	
	None	39.5	
Engaged in informal labour	Men	39.7	*Men primarily shifted to informal work.*
	Women	6.0	
	Children	7.8	
	Men, women, children	10.3	*Child labour emerged as coping practice.*
	None	36.2	
Increased reliance on humanitarian aid	Yes	73.3	Majority dependent on aid in recent years
Received early warning of climate events	Yes	33.9	Limited early-warning coverage

4.8 SOCIO-ECONOMIC VULNERABILITY INDEX

The SeVI values, computed for each of the 118 surveyed households, range from a minimum of 0.36-0.68 (mean = 0.4971 ± 0.0633). The SeVI scores were classified into four ordinal categories: Low (0.00–0.25), Moderate (0.26–0.50), High (0.51–0.75), and Very High (0.76 1.00). However, within the surveyed sample, only two categories, i.e., Moderate and High, were represented. Specifically, 56 households (47.5%), while 62 households (52.5%) were classified as moderately and highly vulnerable, respectively. No households were recorded in the Low category. The prevalence of moderate to high vulnerability among urban households in Peshawar reinforces the need for targeted policy interventions. The absence of cases in the lowest and highest vulnerability brackets warrants further investigation into the sampling frame and the determinants of adaptive capacity within the studied population.

4.8.1 GENDERED IMPACTS ON SeVI

The variations in SeVI were explained using three key gender related predictors i.e. the gender of the household head, whether the household's income was female-led, and the number of female members, using a generalized linear model (GLM)

The GLM given in Table 9, the model fit is statistically significant ($\chi^2 = 15.85$, $p = 0.001$). Results show that neither gender of the household head ($p = 0.729$) nor female-led income ($p = 0.321$) had a statistically significant association with SeVI. However, the number of females per household had a positive and significant association with vulnerability ($B = 0.011$, $p < 0.001$), implying that greater socioeconomic vulnerability is experienced by households with a higher number of female members. Formal gender roles, therefore, had a lesser impact on vulnerability in comparison to household gender composition and dependency. Higher care burdens and limited labor market participation by females within the sample population may have influenced this outcome.

Table 9. Generalised Linear Model Results for Gendered Impacts on SeVI

Variable	B	Std. Error	95% CI (Lower–Upper)	Wald χ^2	Sig. (p)
Intercept	0.466	0.016	0.436 – 0.497	893.874	0.000
Gender of household head (0=Male, 1=Female)	-0.005	0.014	-0.032 – 0.022	0.120	0.729
Female-led income (0=Yes, 1=No)	-0.016	0.016	-0.047 – 0.015	0.983	0.321
Number of females in household	0.011	0.003	0.005 – 0.016	15.893	0.000

4.8.2 DEMOGRAPHIC INFLUENCERS OF SeVI

Among the demographic determinants of the SeVI household composition and settlement duration, exhibited a significant influence on vulnerability (Table 10). The model was statistically significant ($\chi^2 = 24.17$, $p < 0.001$) and showed excellent fit (AIC = -331.62). Larger households are more vulnerable, exhibiting a positive association with SeVI ($B = 0.005$, $p < 0.001$). The age of the household head, however, was negatively associated with SeVI ($B = -0.001$, $p = 0.030$), suggesting that households with more experienced heads may possess

better means to cope with environmental stress. Furthermore, an interesting observation from Table 10 suggests that prolonged residence in an area does not necessarily reduce vulnerability, as years lived in the current area had a small but statistically significant effect (B = 0.001, p = 0.041).

Table 10. Generalised Linear Model Results for Demographic Determinants of SeVI

Variable	B	Std. Error	95% CI (Lower)	95% CI (Upper)	Wald χ^2	Sig. (p)
Intercept	0.481	0.0200	0.441	0.520	574.651	0.000
Household size	0.005	0.0015	0.003	0.008	13.492	0.000
Age of household head	-0.001	0.0004	-0.001	-0.00008	4.732	0.030
Years lived in current area	0.001	0.0004	0.000035	0.002	4.181	0.041

4.8.3 WATER SOURCE AND INCOME STABILITY AS DETERMINANTS OF VULNERABILITY

The GLM model examining the influence of drinking water source and seasonal income was statistically significant ($\chi^2 = 11.97$, df = 4, p = 0.018), showing a good model fit (AIC = –305.07). Table 11 shows that the type of drinking water source is a significant determinant of household vulnerability (Wald $\chi^2 = 11.37$, p = 0.010). Further, households using piped (B = –0.037, p = 0.015), borehole (B = –0.054, p = 0.003), or tanker water (B = –0.057, p = 0.005) reported lower vulnerability scores compared with those relying on “other” sources (e.g. shared, unprotected, or irregular supplies). A negative but non-significant association (B = –0.019, p = 0.092), between SeVI and seasonal income was observed. However, the direction may imply that households with more stable annual incomes may experience slightly lower vulnerability.

Table 11. GLM for Water Source and Seasonal Income as Predictors of SeVI

Variable	B	Std. Error	95% CI (Lower)	95% CI (Upper)	Wald χ^2	Sig. (p)
Intercept	0.546	0.0156	0.515	0.576	1228.075	0.000
Water Source						
Piped	–0.037	0.0153	–0.067	–0.007	5.906	0.015
Borehole	–0.054	0.0180	–0.089	–0.019	9.055	0.003
Tanker	–0.057	0.0203	–0.097	–0.017	7.857	0.005
Other (ref.)	0	—	—	—	—	—
Seasonal income (No)	–0.019	0.0113	–0.041	0.003	2.835	0.092

4.8.4 DISABILITY AND SeVI

The overall model developed for assessing the relation between vulnerability and the presence of disabled household members was statistically significant ($\chi^2 = 7.56$, df = 1, p = 0.006) and showed a good fit (AIC = –299.28). A significant increase in vulnerability was observed in households with disabled persons. Contrarily, households without disabled members recorded significantly lower SeVI scores (B = –0.047, p = 0.005), likely due to higher healthcare costs, reduced earning capacity, and the need for care-related time and resources.

5. POLICY ANALYSIS

5.1 THEMATIC CONTENT ANALYSIS OF THE KP CLIMATE CHANGE POLICY (2022)

This section identifies thematic emphasis and omissions at the discourse level. A systematic content analysis of the Khyber Pakhtunkhwa Climate Change Policy (2022) was conducted to identify the dominant themes and the extent to which operational elements were addressed within the document. These included finance, monitoring, institutional structures, and social inclusion. The analysis was carried out by:

a) Extracting the full text of policy document,
b) searching for pre-defined themes,
c) counting keyword occurrences per theme.

Table 12. Theme keyword frequency in KP Climate Change Policy (2022)

Theme	**Keyword count**
Water & Sanitation	164
Mitigation	152
Institutions & Capacity	88
Adaptation	68
Infrastructure & Urban	67
Agriculture & Food Security	64
Health & Disease	51
Disaster Risk Reduction (DRR)	41
Gender & Inclusion	38
Finance & Budgeting	38
Stakeholders & Community	26
Monitoring & Evaluation	25
Education & Schools	11
Early Warning Systems	7

Social Protection & Safety Nets	0

Source: KP Climate Change Policy (2022), author's content analysis (counts represent raw keyword matches across the full document).

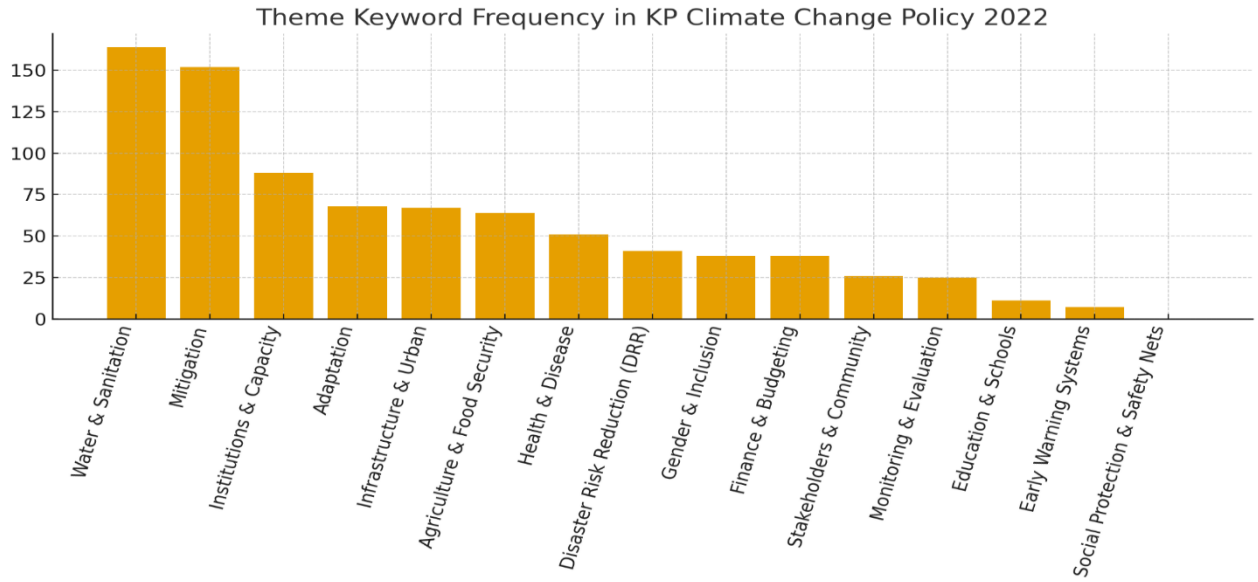

Figure 3. Bar chart of theme frequencies (counts)

Based on the results (Figure 3), it may be mentioned that the policy gives pronounced attention to water resources and sanitation issues. Mitigation-related language (152 counts) is also frequent, which suggests that both adaptation and mitigation are included in the KPs' climate response. Though institutional vocabulary appeared frequently (88 counts), the mentions remain largely descriptive, with a few concrete mechanisms, i.e. budget lines, legal mandates, or inter-departmental operational protocols, that would enable implementation. Furthermore, despite adaptation appeared as a central theme in the narrative, its word count (68) was modest in comparison to the water/mitigation theme.

In addition, the policy often stops short of specifying measurable adaptation outcomes or suggesting explicit indicators. Among other themes, health (51) and agriculture/food security (64) registered significant attention. There is a general recognition of climate-sensitive disease burdens and food system vulnerabilities. Similarly, urban infrastructure (67) is repeatedly referenced, without specific cross-cutting implementation elements. Monitoring & Evaluation (25 hits) and Early Warning Systems (7 hits) showed relatively low occurrence. Social protection and dedicated safety-net language are absent altogether (0 hits). A monitoring and financing gap is, therefore, observed in the document.

The policy tends to call for actions without specifying proper baselines or KPIs, and a shortcoming that is augmented by the Action Plan (2022) to a certain extent. Women and youths are explicitly mentioned in the policy document; however, no gender disaggregated targets, budgets, or monitoring metrics were provided. Similarly, the mentions regarding refugees, internally displaced persons (IDPs), and people with disabilities (PWDs) are sparse, resulting in reduced inclusivity and equity. Further, references to stakeholders, NGO engagement, and community consultations appear in many cases (26 hits). The policy documents multiple consultation events and lists potential partners; however, institutionalized

participatory mechanisms (standing multi-stakeholder platforms with decision-making roles) are not evident from the document. In summary, the KP policy is broad in thematic scope, covering adaptation, mitigation, agriculture, water, health, infrastructure, and institutions, but it is uneven in operational detail while monitoring, financing, social protection, and early warning are comparatively under-represented. The document reads as a policy framing exercise with strong rhetorical alignment to national/global goals but limited actionable commitments, a gap that the Action Plan separately and partly addressed through lists of recommended activities.

5.2 STAKEHOLDER MAPPING (POWER–INTEREST ANALYSIS)

Stakeholders were identified through a close reading of both the KP Climate Change Policy (2022) and the Climate Change Action Plan (2022). Each actor mentioned (governmental, non-governmental, development partners, civil society) was coded into a power–interest matrix, using the following logic: Power, in this case, is the ability to allocate resources, make decisions, or enforce implementation, while interest is the level of stake in climate action. Eventually, this analysis produces four quadrants, i.e. Key players, Context setters, Subjects, and Crowd.

From the analysis (Table 13), it appeared that the bureaucratic institutions, e.g. the Environmental Protection Agency and the Planning & Development Department, were dominant players with authority and responsibility; however, their effectiveness is constrained by weak budget allocations and limited inter-departmental accountability. Unlike the thematic analyses that examine policy content and design, the stakeholder mapping explicitly reveals the power asymmetries that shape whose priorities are translated into action and whose vulnerabilities remain underrepresented

Community stakeholders, such as households, women, youths, IDPs, and PWDs, were identified as high-interest but low-power stakeholders. A rhetorical acknowledgment of their lack of institutionalized representation in decision-making suggested a major *"vulnerability versus the voice gap"*. The private sector is not systematically engaged, despite the fact that it can play a key role in renewable energy and resilience-based investments. Similarly, development partners appeared as powerful enablers with both finance and expertise.

However, the interest of development partners may be project-driven and may fluctuate, hampering the achievement of long-term goals, resulting in sustainability risks. Furthermore, a medium power and high interest was exhibited by Local Governments and NGOs occupying a middle zone and representing a cardinal operational bridge between provincial frameworks and ground realities. These power–interest imbalances help explain the limited operationalization of gender and social inclusion discussed in the preceding section and upcoming later sections.

Table 13. Stakeholders identified in Climate Policy & Action Plan

Stakeholder	Power	Interest	Role / Function (as per Policy & Plan)
Environmental Protection Agency (EPA KP)	High	High	Lead technical body for climate & environment

Planning & Development Department	High	High	Coordination, integration into sector plans
Finance Department	High	Medium	Budget allocation, financial management
Line Departments (Agriculture, Forests, Water, Energy, Health, Urban Dev.)	High	High	Sectoral implementation of adaptation/mitigation
Local Governments (Tehsil/Union Councils)	Medium	High	Implementation at the grassroots: DRR measures
NGOs & Civil Society Organizations	Medium	High	Community mobilization, awareness, and service delivery
Development Partners (UNDP, FAO, GIZ, WB, ADB, etc.)	High	Medium	Technical & financial support for programs
Academia & Research Institutions	Medium	Medium	Climate research, data, innovation
Private Sector (Energy, Industry, SMEs)	Medium	Low	Investment in green technologies, CSR
Women, Youths, and PWDs	Low	High	Most vulnerable groups need targeted inclusion
Farmers & Local Communities	Low	High	Directly exposed to climate risks; adaptation on the ground
IDPs/Refugees	Low	High	Highly vulnerable but politically marginalized
Media (TV, Radio, Social Media)	Medium	Medium	Awareness, early warning dissemination

5.3 POLICY COHERENCE ANALYSIS

A coherence analysis was undertaken to assess how the Khyber Pakhtunkhwa Climate Change Policy 2022 (hereafter “Policy”) and the KP Climate Change Action Plan 2022 (hereafter “Action Plan”) align with international climate governance frameworks, national policy commitments, and operational design criteria. The assessment was guided by established coherence frameworks (Nilsson et al., 2012) and focused on both vertical

coherence (consistency with international and national goals) and horizontal coherence (internal consistency across sectors, instruments, and implementation mechanisms).

5.3.1 ALIGNMENT WITH INTERNATIONAL FRAMEWORKS

Paris Agreement (2015): The Policy acknowledges Pakistan's Nationally Determined Contributions (NDCs) and commits to supporting emission reduction and adaptation efforts. The Action Plan references similar priorities, including renewable energy promotion and climate-smart agriculture. However, neither document translates global targets into province-specific quantified goals, such as greenhouse gas reduction trajectories or adaptation benchmarks. This creates a gap between rhetorical commitment and measurable alignment, limiting KP's ability to demonstrate its contribution to national NDCs.

Sustainable Development Goal 13 (SDG 13: Climate Action): Both the Policy and Action Plan emphasize adaptation, resilience-building, and awareness campaigns, which echo SDG 13.1 and 13.3. Yet, there is no framework of indicators or baseline data to monitor progress against SDG metrics. The Action Plan introduces activity lists but without integration into the SDG indicator monitoring architecture, thereby constraining reporting and comparability.

Sendai Framework for Disaster Risk Reduction (2015–2030): References to disaster risk management appear in both documents, particularly regarding floods, early warning, and community preparedness. The Action Plan outlines tasks for enhancing early-warning systems and disaster response capacity. However, DRR is not mainstreamed across all climate sectors (e.g. urban planning, livelihoods), nor are institutional arrangements clarified for PDMA–EPA coordination. This weakens horizontal integration between climate adaptation and disaster governance, despite the Sendai Framework's emphasis on systemic resilience.

5.3.2 ALIGNMENT WITH NATIONAL FRAMEWORKS

Pakistan National Climate Change Policy (NCCP 2021): The Policy exhibits strong thematic alignment with the NCCP, echoing its priorities on renewable energy, afforestation, and institutional strengthening. The Action Plan operationalizes these priorities through task lists. However, neither document establishes a monitoring system that directly links KP's actions to NCCP indicators. This absence of vertical integration reduces accountability between the provincial and federal levels.

National Adaptation Plan (2022): While the national plan emphasizes sectoral adaptation pathways, KP's Action Plan includes similar elements (e.g. agriculture, water, and energy). Still, the lack of costed actions or baseline data prevents effective integration into the national adaptation reporting process.

5.3.3 OPERATIONAL DESIGN COHERENCE

Financing and Budgeting: The Policy contains no cost action plans or dedicated financing streams. The Action Plan provides activity lists, but rarely specifies funding sources or allocation breakdowns (domestic vs. donor). Without explicit budget lines, operational coherence remains weak, leaving implementation dependent on ad hoc funding.

Monitoring and Evaluation (M&E): The Policy refers vaguely to the establishment of monitoring mechanisms, while the Action Plan tasks agencies with preparing baselines and progress reports. However, neither document defines clear KPIs, reporting cycles, or independent verification arrangements. The absence of standardized indicators undermines coherence with both national reporting obligations and international frameworks (e.g. SDG reporting).

Targets and Timelines: The Policy articulates broad goals but lacks time-bound targets. The Action Plan improves coherence by classifying actions as “short-term,” “medium-term,” and “long-term” (Action Plan, Annex). Yet this prioritization is inconsistent across sectors, and in many cases timelines are aspirational rather than operational. The lack of synchronized milestones weakens both accountability and inter-agency coordination.

Gender and Social Inclusion: The Policy includes a brief reference to “women’s participation”, but without indicators, gender-responsive budgeting, or concrete actions. The Action Plan refers to community engagement but again lacks gender-disaggregated targets or specific mechanisms to include marginalized groups (e.g. IDPs, refugees, and persons with disabilities). This results in symbolic rather than substantive inclusion, falling short of global best practices on gender mainstreaming in climate policy (UNFCCC Gender Action Plan, 2019).

Early Warning System (EWS) and Disaster Preparedness: The Action Plan provides relatively stronger detail here, listing improvements to communication systems and community-based preparedness programmes. However, coherence is weakened by the lack of an institutional lead agency, cross-sector coordination mechanism, or secured financing. Without these, the proposed EWS remains aspirational.

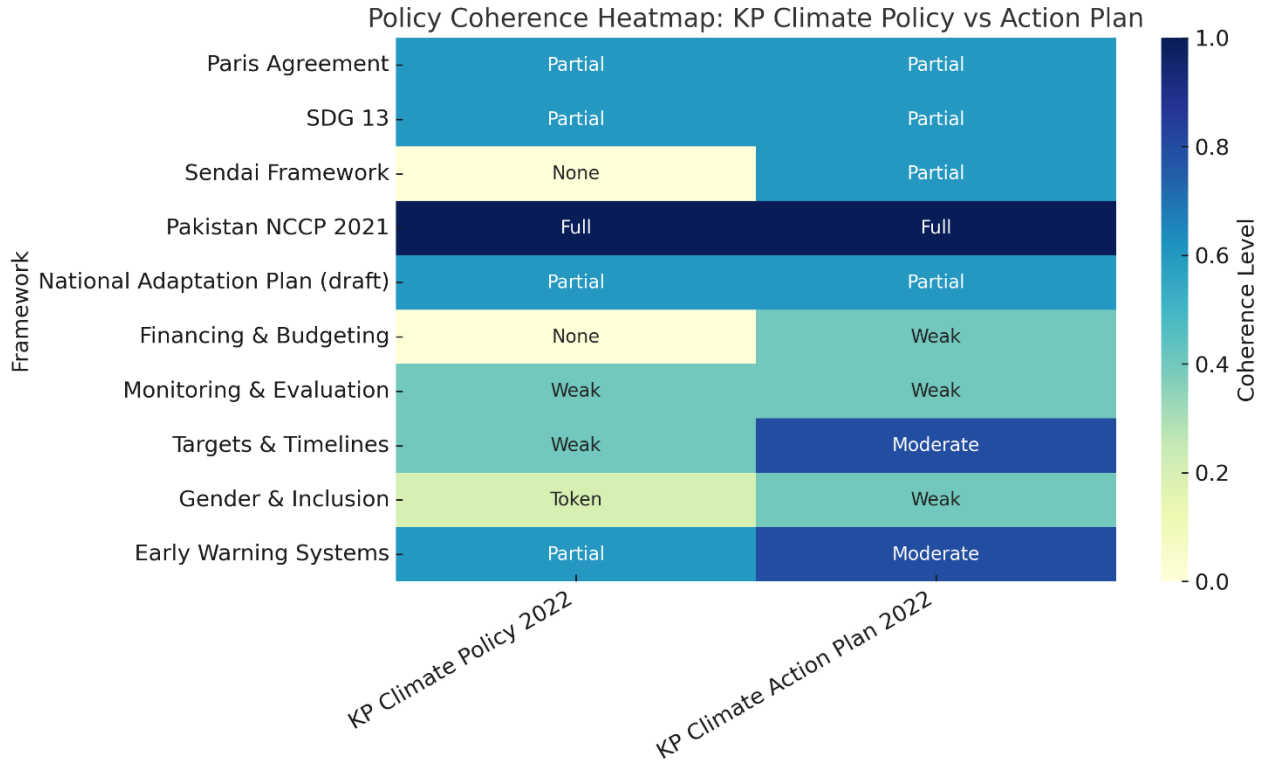

Figure 4: Policy coherence heatmap

5.4 INSTITUTIONAL AND IMPLEMENTATION ANALYSIS

This section critically assesses the institutional and implementation aspects of the Khyber Pakhtunkhwa Climate Change Policy 2022 and the Climate Change Action Plan 2022 using Ostrom’s Institutional Analysis and Development (IAD) framework. The IAD framework offers a systematic way to analyze governance arrangements by examining how rules, actors, and

interaction arenas collectively influence policy outcomes (Ostrom, 2005). Using this approach helps to better understand whether KP has the institutional clarity, authority, and resources needed to implement its climate commitments successfully.

5.4.1 ANALYTICAL FRAMEWORK

The IAD framework identifies three critical elements for analysis:

1. Rules-in-Form: Formal laws, mandates, and policy instruments.
2. Actors and Roles: The distribution of authority across government agencies and non-state actors.
3. Action Arenas: The operational mechanisms where decisions are taken, implemented, and monitored.

Within this framework, six evaluation dimensions were identified as particularly relevant for climate policy implementation in KP:

- Legal Mandates and Authority
- Lead Agencies and Roles
- Inter-departmental Coordination
- Budgetary and Financial Clarity
- Monitoring, Evaluation, and Learning (MEL)
- Stakeholder Participation and Inclusiveness

Each dimension was scored on a scale from 1 (weak) to 3 (strong) based on evidence drawn directly from the policy and action plan.

Legal Mandates and Authority: The Policy (2022) articulates strategic goals such as mainstreaming adaptation and strengthening climate resilience, but it lacks statutory backing. Agencies such as the EPA and the Planning & Development Department are mentioned, yet the documents do not grant them legally enforceable powers. Similarly, the Action Plan (2022) specifies departmental responsibilities but is not supported by legislation. This weakens the ability of institutions to enforce compliance.

Lead Agencies and Roles: Both the Policy and Action Plan identify the Environment Protection Agency (EPA) and the Planning & Development Department (P&D) as lead institutions. While the Action Plan allocates responsibilities to additional line departments (Agriculture, Forestry, Energy, Disaster Management), the absence of clear chains of accountability leaves ambiguity in practice.

Inter-departmental Coordination: The Policy emphasizes a “whole-of-government” approach, but coordination mechanisms remain vague. The Action Plan introduces departmental matrices that assign responsibilities, but these lack cross-sectoral linkages — for example, between agriculture, water, and urban planning — where climate vulnerabilities intersect.

Budgetary and Financial Clarity: Both the Policy and Action Plan are weakest in terms of financial specificity. The Policy calls for mobilizing domestic and international climate finance but does not provide sectoral budget estimates. The Action Plan lists actions and departmental responsibilities but does not assign financial allocations, rendering the plan aspirational.

Monitoring, Evaluation, and Learning (MEL): The Policy suggests that monitoring and evaluation will be conducted by provincial authorities but does not establish indicators or timelines. The Action Plan mentions annual reporting and review, but no baseline values, KPIs, or performance frameworks are included.

Stakeholder Participation and Inclusiveness: Although both documents highlight the role of communities, NGOs, and development partners, they lack concrete mechanisms for inclusion. There are no quotas or dedicated resources for vulnerable groups such as women, youths, or persons with disabilities. Stakeholder engagement remains largely rhetorical rather than operational.

Table 14: Summary Table of IAD Scores

Indicator	Policy 2022	Action Plan 2022	Remarks
Legal Mandates and Authority	2	2	Mandates exist but lack statutory enforcement.
Lead Agencies and Roles	2	3	Lead agencies identified; accountability still vague.
Inter-departmental Coordination	2	2	No binding mechanism for cross-sectoral alignment.
Budgetary and Financial Clarity	1	1	Absence of costed plans or financing strategies.
Monitoring, Evaluation, and Learning	2	2	Reporting proposed but lacks KPIs, baselines, and timelines.
Stakeholder Participation	1	2	Mentioned but no structured participatory frameworks.

The analysis highlights significant institutional weaknesses across both documents. The Policy (2022) sets an ambitious strategic vision but remains largely normative, while the Action Plan (2022) moves closer to operationalization by specifying departmental responsibilities. However, both fail to establish enforceable rules, cos-effective budgets, and clear monitoring frameworks.

This institutional fragility risks turning the policy into a symbolic instrument rather than an actionable roadmap. Without statutory authority, cross-sectoral coordination, and financial commitments, climate adaptation in KP may remain fragmented and under-resourced. These findings are consistent with broader critiques of climate governance in South Asia, where policies often emphasize vision but underperform on delivery due to weak institutions and unclear accountability (Huitema et al. 2011; Jordan & Huitema, 2014).

5.5 SMART EVALUATION OF POLICY OBJECTIVES

The SMART framework (Doran, 1981; UNDP, 2009) provides a systematic approach to evaluate whether stated policy objectives are actionable and monitorable. Objectives that are vague or aspirational in nature typically lack measurability or time-bound commitments, reducing their effectiveness in driving implementation. Applying the SMART criteria to the KP Climate Change Policy (2022) and the KP Climate Change Action Plan (2022–2030)**,** this section reveals key differences in framing, operational detail, and practical feasibility.

5.5.1 KP CLIMATE CHANGE POLICY (2022)

The Khyber Pakhtunkhwa Climate Change Policy (2022) presents a comprehensive narrative framework that signals a strong provincial commitment for the redressal of challenges of climate variability and environmental degradation. However, when subjected to the SMART evaluation framework, the policy reveals critical shortcomings in terms of operational precision. While many of its objectives are articulated with a degree of sectoral specificity — for instance, in relation to renewable energy, forestry, agriculture, or water management — they remain primarily aspirational in nature. The language employed is directional rather than prescriptive, offering broad commitments such as “promote renewable energy” or “strengthen public awareness,” yet without detailing measurable indicators, quantitative targets, or clearly defined timelines. This lack of operational clarity significantly weakens the policy’s capacity to guide effective implementation, monitoring, and evaluation.

The absence of measurable benchmarks is particularly problematic. Without defined targets (e.g. megawatts of renewable energy to be installed, number of awareness campaigns to be conducted, or hectares of land to be afforested), it becomes difficult to assess progress, allocate resources effectively, or hold implementing agencies accountable. Similarly, the absence of time-bound commitments means that even where objectives are theoretically achievable, they risk remaining indefinitely postponed. This undermines both institutional accountability and the ability to align provincial goals with national and international climate frameworks such as the Paris Agreement or the Sustainable Development Goals.

Furthermore, while the policy emphasizes relevance by aligning itself with pressing provincial needs, such as disaster risk management and ecosystem preservation, its lack of measurable and time-bound commitments results in a credibility gap. In effect, the policy provides a strong vision but falls short as a practical roadmap. This gap between ambition and operationalization highlights the need for subsequent instruments, such as the KP Climate Change Action Plan, to serve as corrective mechanisms by embedding targets, timelines, and monitoring frameworks that translate vision into verifiable outcomes.

Table 15: SMART Evaluation of KP Climate Change Policy (2022)

Objective	Specific (S)	Measurable (M)	Achievable (A)	Relevant (R)	Time-bound (T)	Total (0–5)	Remarks
Promote renewable energy	✔	✗	✔	✔	✗	3	Directional objective lacks numerical targets or timelines.
Enhance early warning systems	✔	✗	✔	✔	✗	3	General intent, no detailed indicators or institutional responsibility.
Mainstream climate adaptation in development	✔	✗	✔	✔	✗	3	Broadly framed, not tied to KPIs or reporting cycles.
Improve urban drainage	✔	✔	✔	✔	✔	5	Clear reference to urban flooding, with implementable potential.
Promote public awareness	✔	✗	✔	✔	✗	3	Focused but lacks structure for monitoring or evaluation.
Strengthen institutional capacity	✔	✔	✔	✔	✗	4	Specific measures exist, but are not linked to timelines.

The KP Climate Change Policy (2022) is largely normative rather than operational. Its objectives are relevant and achievable in principle but do not contain measurable indicators or time-bound commitments, which weakens accountability.

5.5.2 KP CLIMATE CHANGE ACTION PLAN (2022–2030)

The Action Plan performs considerably better on the SMART framework because it translates policy aspirations into sectoral actions with timelines (2022–2030), sectoral costing, and institutional responsibilities. However, gaps remain in the measurability dimension for some objectives, particularly those related to social inclusion and awareness.

Table 16: SMART Evaluation of KP Climate Change Action Plan (2022–2030)

Objective	S	M	A	R	T	Total (0–5)	Remarks
Expand renewable energy (solar, micro-hydro, biogas)	✔	✔	✔	✔	✔	5	Specific targets, costed, and time-bound.
Develop climate-smart agriculture	✔	✔	✔	✔	✔	5	Specific techniques, pilot projects, and a phased plan.
Establish early warning & disaster risk systems	✔	✔	✔	✔	✔	5	Multi-hazard EWS is described, with institutional lead and timelines.
Improve water conservation and irrigation efficiency	✔	✔	✔	✔	✔	5	Clear water efficiency measures, phased investments.
Promote gender and youths inclusion	✔	✗	✔	✔	✗	3	Inclusion noted, but lacks measurable indicators or allocated budgets.
Build institutional and human resource capacity	✔	✔	✔	✔	✔	5	Training programs and inter-agency structures included.

The Action Plan's strength lies in its time-boundedness and achievability, particularly in the infrastructure and energy sectors. However, social dimensions such as gender mainstreaming and inclusivity are weakly operationalized, reflecting a gap between rhetoric and measurable action.

The comparison reveals a policy implementation gap: The Policy provides broad aspirational direction, whereas the Action Plan operationalizes objectives with greater specificity, measurability, and time-bounded commitments. However, both documents underperform in social inclusivity (gender, youths, displaced persons), suggesting the need for SMART targets that explicitly address vulnerable groups.

5.6 GENDER & VULNERABILITY ANALYSIS

The gender and vulnerability lens was applied to both the Khyber Pakhtunkhwa Climate Change Policy (2022) and the Climate Change Action Plan (2023) to evaluate the extent to which inclusivity has been mainstreamed. This method is widely used in climate governance assessments (Hahn et al., 2009; UNDP, 2016) and seeks to determine whether policy frameworks address the differentiated needs of women, youths, internally displaced persons (IDPs), persons with disabilities (PWDs), and other marginalized groups. A checklist approach was adopted, assigning scores (0–2) across inclusion dimensions, where 0 = absent, 0.5 = weak/implicit, 1 = explicit mention without mechanisms, and 2 = strong operationalization with measurable indicators.

Table 17: Gender & Vulnerability Inclusion Checklist

Inclusion Area	Policy (2022)	Action Plan (2023)	Score (0–2)	Notes
Women Participation	Mentioned	Partial	1	Policy acknowledges role; Action Plan lists activities, but lacks KPIs
Gender-Disaggregated Data	Absent	Absent	0	No commitment to sex-disaggregated M&E
Gender Budgeting	Absent	Absent	0	No allocation mechanism to ensure equity
Youths Engagement	Absent	Partial	0.5	Policy silent; Action Plan briefly notes youth awareness activities
People with Disabilities (PWDs)	Absent	Absent	0	No mention of inclusion in adaptation/resilience planning
IDPs / Displaced Populations	Mentioned	Partial	1	Recognized in disaster relief, but no structural strategy
Marginalized Communities (Ethnic/poor)	Absent	Partial	0.5	Action Plan mentions “community participation,” but no concrete focus
Social Safety Nets	Absent	Absent	0	No mention of targeted support or cash transfers
Climate-Induced Migration/Relocation	Mentioned	Partial	1	Alluded to under DRR; no tailored actions
Intersectionality (multiple identities)	Absent	Absent	0	No analysis of overlapping vulnerabilities

The analysis demonstrates that while the KP Climate Change Policy and Action Plan rhetorically acknowledges the importance of vulnerable populations, the operational commitments remain weak. Women are cited as participants in climate governance, but without measurable actions, gender budgeting, or accountability mechanisms. Similarly, the youths are referenced only in awareness contexts, rather than being integrated into structured adaptation programmes. The complete absence of PWD inclusion signals a critical oversight, especially considering their heightened sensitivity to mobility and health-related challenges during climate disasters.

The documents fare slightly better in recognizing IDPs and migration-related vulnerabilities, but again, the measures remain broad and lack targeted institutional pathways. The Action Plan introduced a degree of improvement by referencing community participation, but the absence of gender-disaggregated data, intersectional frameworks, or financial commitments renders these efforts symbolic rather than transformative.

Collectively, the policy analysis revealed a consistent pattern: while KP's climate governance architecture is rhetorically aligned with global norms, weaknesses in coherence, institutional authority, financing, and inclusion persist across instruments. Each analytical lens i.e. content, stakeholder, coherence, institutional, SMART, and gender, used in this study highlighted a distinct dimension of this governance gap.

6. POLICY RECOMMENDATIONS

Building on empirical insights from the SeVI and thematic findings from household-level data, complemented by a detailed review of the KP Climate Change Policy (2022) and its Action Plan (2022–2030), the targeted policy measures are given to enhance climate resilience among Afghan refugee households in urban Peshawar. The recommendations are intended to guide authorities, humanitarian partners, and development agencies in designing inclusive, evidence-based climate adaptation strategies.

6.1 IMPROVE WATER SECURITY AND URBAN INFRASTRUCTURE

- Regression analysis identified water source as a major determinant of vulnerability. Households relying on tanker or irregular sources exhibited higher SeVI scores. Investment in piped water supply networks, community boreholes, and regulated water quality monitoring is essential, especially in refugee-concentrated urban settlements.
- Higher vulnerability was observed among residents of kutcha and semi-pucca dwellings. The provincial government and municipal bodies should support low-cost housing retrofitting, roof insulation, solar integration, and flood-proof designs under climate adaptation programs.
- Only 44.9% of households reported access to energy-efficient streetlights. Sustainable urban lighting using solar technologies should be expanded to improve nighttime safety, reduce energy dependence, and contribute to climate mitigation goals outlined in the KP policy.

6.2 STRENGTHEN LIVELIHOODS AND ECONOMIC RESILIENCE

- The SeVI results indicate that households dependent on seasonal income are more vulnerable to climate shocks. Interventions such as vocational training, microcredit schemes, and home-based enterprise development should be tailored to the needs of refugees and informal workers.

- While female-led income was not statistically significant, the number of female members was strongly linked to higher vulnerability. Scaling up women's employment programmes, skills development, and access to credit can reduce gendered vulnerability and support equitable adaptation.
- A large share of refugees work in unregulated occupations: Incorporating informal workers into social protection, occupational safety, and micro-insurance frameworks will strengthen livelihood resilience.

6.3 ADDRESS HEALTH AND DISABILITY-RELATED VULNERABILITIES

- Households with disabled members exhibited higher SeVI scores. Provincial disaster management and health departments should ensure inclusive early warning systems, accessible shelters, and targeted medical support for persons with disabilities.
- High prevalence of heat-related illnesses, respiratory conditions, and climate-induced stress underscores the need for mobile health units, community health workers, and psychosocial support initiatives in refugee settlements.
- Despite high reported access to sanitation, maintenance and safety remain major concerns. Gender-sensitive WASH interventions should prioritize hygiene facilities for women, children, and persons with disabilities.

6.4 SAFEGUARD EDUCATION AND CHILD WELL-BEING

- Evidence from the survey revealed school dropouts and disruptions, particularly among girls. Emergency education plans, temporary learning spaces, and conditional cash transfers can protect educational outcomes during crises.
- Curriculum reforms and school infrastructure upgrades must incorporate climate literacy and disaster preparedness, aligning with the KP Action Plan's commitment to climate-smart education.

6.5 ENHANCE CLIMATE AWARENESS AND EARLY WARNING SYSTEMS

- Only one-third of households reported receiving early warnings, mostly through television. Expanding to mobile-based alerts, community radio, and local mosque networks will increase coverage and inclusivity.
- Limited trust in existing systems reduces responsiveness. Community engagement in warning design, co-production of risk messages, and training of local facilitators can improve uptake.
- Awareness programmes should target both men and women and focus on actionable adaptation practices — water conservation, waste management, and sustainable energy use.

6.6 FOSTER INCLUSIVE GOVERNANCE AND INSTITUTIONAL COORDINATION

- Collaboration between the Afghan Commissionerate, PDMA, local government, and humanitarian actors is critical for locally grounded implementation of adaptation actions.
- Gender equity must be mainstreamed across policy design, budgeting, and monitoring frameworks, ensuring accountability for gendered outcomes.
- The Socioeconomic Vulnerability Index developed through this study can serve as a diagnostic tool for identifying high-risk zones and guiding evidence-based resource prioritization within the KP Climate Action Plan.

6.7 STRENGTHEN CLIMATE GOVERNANCE, FINANCING, AND ACCOUNTABILITY

- Provide statutory authority to KP's climate institutions, clarifying mandates for adaptation financing, coordination, and enforcement.
- Build indicators aligned with SDGs and NCCP to track equitable policy outcomes.
- Link adaptation measures to specific budget lines under provincial and donor-supported frameworks.
- Form a climate and DRR coordination council with binding authority and inclusive representation of women, youths, and refugees.
- Implement third-party monitoring and annual progress reviews to improve accountability and public trust.

7. CONCLUSION

This study provides empirical evidence on the socioeconomic vulnerability of Afghan refugee households living in urban Peshawar, highlighting how climate-induced stressors intersect with livelihood insecurity, gender dynamics, and service access to shape household resilience. Using a composite SeVI, the analysis quantified exposure, sensitivity, and adaptive capacity across multiple dimensions — revealing that all surveyed households fall within moderate to high vulnerability levels.

The results demonstrate that household size, gender composition, housing conditions, water source, and the presence of disabled members are significant determinants of vulnerability. Secure access to piped or borehole water, improved housing structures, and stable income sources were associated with lower SeVI scores whereas large household size, seasonal income dependence, and disability within the household heightened vulnerability. Gender analysis further accentuated the differentiated experiences of men and women, suggesting that female members face structural disadvantages in adaptation and decision-making.

Beyond household-level findings, a review of the KP Climate Change Policy (2022) and Action Plan (2022–2030) revealed strong emphasis on mitigation and institutional frameworks but limited operational focus on vulnerable and displaced populations. The lack of refugee-sensitive adaptation measures, weak coordination mechanisms, and absence of measurable implementation indicators constrain the policy's effectiveness in addressing ground realities.

This underlines the need for evidence-driven, inclusive, and gender-responsive climate governance. Strengthening urban infrastructure, water security, livelihood diversification, and social protection systems will be central to enhancing the adaptive capacity of Afghan refugees. The SeVI developed in this study offers a valuable tool for targeted policy design and resource allocation, supporting the broader vision of climate-resilient urban development in Khyber Pakhtunkhwa.

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