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## Developing Climate-Resilient and Sustainable Housing in Pakistan: Challenges and Opportunities

## Abstract

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**Keywords:** Adaptable, Climate-Resilient, Housing, Pakistan, Sustainable, Vulnerable

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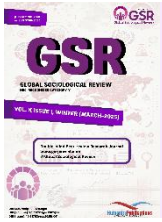

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## Title

# Developing Climate-Resilient and Sustainable Housing in Pakistan: Challenges and Opportunities

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## Contents



## Abstract

*The housing sector has been globally affected by climate change. To mitigate the impacts, there is an urgent need to revise housing strategies to combat these challenges and increase the overall resilience of the built environment. Houses in Pakistan are not built to withstand the challenges posed by climate change. Resilience is the ability of buildings to adapt to climate-related stressors while maintaining the well-being of its residents. This study examines the concept of resilience, its significance in the housing sector, and the pressing need for climate adaptation in Pakistan's housing sector. After reviewing the literature, the study highlights the primary challenges to adopting resilient housing alternatives into practice. The results emphasize how urgently integrated planning, environmentally friendly building methods, and interventions in policy are needed to improve housing resilience. By taking these factors into account, Pakistan can guarantee housing solutions that offer climate adaptation and long-term sustainability.*

**Keywords:** Adaptable, Climate-Resilient, Housing, Pakistan, Sustainable, Vulnerable

## Introduction

Pakistan is a big country with an area of more than 796000 km2 and has a wide range of weather patterns. Extreme weather events in Pakistan demonstrate the country's susceptibility to climate change. It is among the top ten countries with the greatest climate change impact in the last two decades (Global Climate Risk Index, 2021). This is evident through the flood of 2010, when it caused 1600 fatalities, flooded 38,600 square kilometers km2 in water, and overall caused damage of $10 billion (Waseem & Rana, 2023). The combined consequences of climate change and inadequate housing infrastructure severely threaten Pakistan's economic development and progress. (van der Geest & Ajani, 2021).

In the light of numerous climate and weather-related risks in Pakistan, it is crucial to recognize climate vulnerabilities and their potential impacts on people, communities, and sectors both in the present and in the future to address the country's sustainable development issues (Kataoka et al., 2022).

At present there is the utmost need to identify the climate change risks the country could face in the future and prepare for adaption alternatives in such a scenario. This research focuses on the identification of vulnerabilities in housing due to climate change and the need for resilience in housing development to ensure adaptable designs and knowledge base innovative solutions for sustainable development in the future.

The ability of the built environment to modify, withstand, and adjust throughout time in response to effects or changes is known as resilience (Garcia & Vale, 2017). Resilience and sustainability are regarded as primary objectives of modern design. At the same time, climate resilience has recently been a wider emphasis for urban planners and designers. In various climatic circumstances, traditional building techniques and materials have not worked well. With millions of people in need of appropriate living places and the need to do so in a way that supports cities' long-term survival, a substantial shift in housing policy and practices is needed. This dynamism, however, could not be strengthened if attention was not paid to the 11$^{th}$ goal of the Sustainable Development Goals (SDGs), which aims to create safe, inclusive, resilient, and sustainable cities and human settlements (Habitat for Humanity, 2021).

One of the most important economic sectors is housing upgrading, which supports sustainability and the prosperity of urban growth. Housing is a major concern for people all over the world since a nation's ability to provide its citizens with a particular standard of living is a reflection of that nation's well-being. An ideal balance between sustainable housing and user satisfaction is necessary for the creation of successful sustainable housing (Almusaed & Almssad, 2022).

The research gap revealed from this study is identifying sustainable and resilient housing in residential communities that satisfy the environmental, social, and economic challenges faced by middle- and low-income groups. The research challenge thus arose from the lack of clarity on the need for climate-smart housing and glaring gaps in policy and building regulations to achieve resilient housing according to the standards of economic, social, and environmental sustainability. Consequently, if sustainable changes are to be implemented soon, activities aimed at increasing capacity and making sure that authorities receive much-needed clarification should take precedence over the creation and application of new standardized building rules in the future.

## Literature Review

An increasing worldwide concern, climate change is creating extreme weather events that have a significant influence on housing systems. Globally, rising sea levels, floods, storms, and temperatures are making homes more vulnerable, especially in areas with inadequate infrastructure. The need for resilient housing is growing as climate hazards increase. This section examines the major vulnerabilities, the worldwide effects of climate change on housing, and the particular difficulties Pakistan faces.

## Climate Change and Challenges Faced Globally

Housing is one of the most crucial components in creating the social fabric, serving as a cornerstone for the realization of numerous human rights. Proper housing is not a stand-alone human right; rather, it is a prerequisite for meeting other basic requirements, such as those pertaining to work, health, social security, privacy, and education (Noonan & Watson, 2017). However, every aspect of human rights implementation is being severely impacted by the global climate change issue (Levy & Patz, 2015). A growing number of catastrophic weather events and extended exposure to unfavorable climate conditions cause substantial damage, forced relocation, and displacement, which necessitates the creation of subpar or even cruel living circumstances. Thus, to minimize or completely eliminate hazards, the aim of municipal climate adaptation should be to provide cities with strategies and ideas for anticipating and managing current and future climate risks (Häußler & Haupt, 2021).

For the twenty-first century, the observed climate scenarios are examples of the issues worldwide that are anticipated to rise over the next century due to climate change. In lower-income countries, weather-related disasters accounted for roughly 90% of all deaths, although they experienced only 25% of all weather events over the previous 20 years (UNISDR, 2015). It is acknowledged by the scientific community that changes in climate are causing an increase in the intensity, frequency, regional extent, length, and timing of extreme weather and climate events, which increases the risks associated with the climate.

From 2000 to 2019, worldwide there have been 361 disasters each year on average. These calamities had an impact on 91 million people around the world in 2019. Estimates indicate, 0.4% of the world's GDP was lost as a result of weather- and climate-related disasters in 2017 (CRED et al., 2023). Though all occurrences cannot be linked to climate change, the frequency, severity, and unpredictability of extreme climatic events are rising, having a greater influence on our built environment and forging a call for attention.

## Housing Vulnerabilities due to Climate Change

Humans coexist in a dynamically adapted ecological relationship with their surroundings, contending with various natural hazards that pose a threat to their life and property. Most natural catastrophes that have an impact on civilization are caused by floods, which are also the most prevalent type of danger. Floods do significant harm to the nation's property and populace each year. Most housing in Asia, especially in rural areas, is extremely unstable and unable to sustain the tremendous stresses created during these natural disasters (United Nations & Pacific, 2018).

As the population of rural areas grows, more communities are being forced into floodplains, making homes more susceptible to regular floods. Many houses, usually on marshy or agricultural grounds, are constructed without adequate drainage or sanitation, making them extremely vulnerable to water damage. Flood depth, duration, soil saturation, and flood current force are some of the factors that affect the amount of damage. Flooding can result in major structural problems that put residents at great risk, such as bowing floors, weakening walls, and foundation fissures (Chohan et al., 2024). Long-term home instability is also caused by secondary risks such as severe winds, storms, and ground settlement, which intensify the damage (Flint & Luloff, 2005).

Inappropriate housing solutions and poorly constructed homes have been identified as one of the main sources of vulnerabilities to climate hazards. A house's vulnerability to the negative effects of natural hazards will increase if it is not constructed with appropriate structures, materials, design, and building techniques that address the need to lower the risk of disaster. Also, there are differences in the socioeconomic status of households, which impacts their level of housing vulnerability (Liu et al., 2019). Financial pressures from recovery and restoration costs are common for homes in climate-affected locations. These difficulties place a significant burden on locals, leading to ongoing financial commitments and the burden of debt repayment (Chohan et al., 2024).

However, developing nations are characterized by profound socioeconomic inequality, widespread and unstable informal settlements, significant land tenure insecurity, and large populations dependent on the informal economy (Bera et al., 2023). Consequently, as externalities of productive activities, this mismatch between urban growth and the problems it faces would only make cities more vulnerable and less competitive in the social, economic, and environmental domains (Ru & Mack-Vergara, 2023). In this context, resilience and sustainability have become paramount for cities worldwide.

Resilience is the capacity of a city to endure and bounce back from unfavorable circumstances, while sustainability is the goal of addressing current needs without compromising the needs of future generations (Li et al., 2022). Together, resilience and sustainability are crucial for maintaining livable, safe, and productive urban communities.

By prioritizing resilient and sustainable approaches in practice, cities may improve resource management, reduce their environmental impact, and raise the living standards of their residents. Furthermore, resilient and sustainable urban planning is essential for maintaining economic stability, minimizing the consequences of climate change, and

promoting social justice (Sharifi et al., 2024). Prioritizing sustainability and resilience is not only desirable but also essential for cities' long-term survival and prosperity as they grow and transform. Innovative strategies must be developed to assist developing countries with housing-related challenges, with an emphasis on sustainability and resilience (Ru & Mack-Vergara, 2023).

## Resilience and Climate Adaption

The definition of resilience is complex and has multiple meanings in different contexts (Meerow et al., 2016). Engineers originally used the term "resilience" to describe a material's capacity to revert to its original state after stress (Pimm, 1984). According to its earliest theorist, Hollings (1973), resilience refers to efficiency, stability, and predictability as essential qualities in secured design and engineering. In ecology, the term "resilience" was also used by Holling (1973) to refer to an ecosystem's capacity to take in and adjust to change while maintaining its current state of functioning. To better understand how humans and the environment interact, the ecological concept of resilience was introduced in the last decade of the 1980s (Bhamra et al., 2011). The notion of resilience was applied in this situation to understand the intricacy of change and the relationships between the people and the environment. More recently, the social aspects of transformation have been incorporated into resilience research (Bhamra *et al.*, 2011).

The term resilience is widely employed similarly to the concept of "bouncing back" which recalls the Latin source *resiliere* that subjects "to jump back" (Sterr et al., 2003). Different researchers and organizations have given different definitions of resilience. In this case, disaster or hazard event perspectives are used to examine resilience. UNISDR states that “it is the ability of a system, group, or society exposed to risks to resist, absorb, accommodate, and recover from a hazard's repercussions in a timely and efficient manner” (Hochrainer-Stigler et al., 2018).

Social resilience investigates dynamic interaction between people and the environment to understand how communities adapt to climate-related challenges (Folke *et al.*, 2010). The concept has been applied to explore resource dependency and coexistence with natural hazards (Flint and Luloff, 2005). A resilience perspective recognizes the ecological, social, and psychological dimensions of diverse communities, with its key emphasis on adapting and maintaining its core function (Kelly & Adger, 2000).

The origins and various perspectives of resilience are summarized in a more recent study by Maguire and Cartwright, which also offers an updated explanation of its techniques. The resilience strategy, according to the report, identifies the resources and adaptive capacity that a community can utilize to overcome the problems that may result from change. To overcome vulnerabilities, the strategy draws on a community's innate capabilities rather than just depending on outside initiatives. (Schneiderbauer & Ehrlich, 2004).

Consequently, discussing innovative strategies is crucial to helping developing countries with housing-related problems while putting a greater emphasis on sustainability and resilience. Consequently, studies of the future of cities are being conducted from a holistic viewpoint that guarantees the potential of cities to expand and develop and promotes the idea that housing is a crucial part of the urban fabric (General, 2023).

## Impacts of climate change on Pakistan

While every nation on the planet is affected by climate change, developing nations like Pakistan are particularly vulnerable to its catastrophic weather events even if they have very low carbon footprints. Both socioeconomic sectors and natural ecosystems are impacted by climate change. Pakistan's climate vulnerability has significant social repercussions in addition to serious environmental and financial ones. According to the UNHCR, there are currently almost 20 million migrants in the country as a result of climate change, a substantial rise over the previous ten years. The projected consequences of displacement, livestock losses, and fatalities are expected to exacerbate the fragility of the rule of law, health, and food security sectors, hence creating an imbalance within Pakistan's entire social fabric (DAWE, 2021).

## The Current State of Climate Vulnerabilities in Pakistan

Pakistan is widely acknowledged for being vulnerable to the consequences of climate change. The nation is experiencing an increase in the frequency and intensity of extreme weather events, including floods, droughts, cyclones, torrential rainstorms, extremely high temperatures, etc., due to the trend toward higher temperatures. Based on observations, it is evident that different regions of Pakistan experience varying levels of climate stress. For instance, landslides, floods, and snowstorms are common in the northern regions. Coastal areas are susceptible to flooding and cyclones. Central areas and mid-river basins are mostly vulnerable to flooding, whereas southern Punjab, Sindh, and Baluchistan are vulnerable to drought (Adnan et al., 2020; Ghazanfar et al., 2009). Since 2000, the monsoon's variability has significantly elevated. Thus, since 2010, Pakistan has experienced annual floods of various sizes, causing significant property damage and a high death toll (Ullah, 2016).

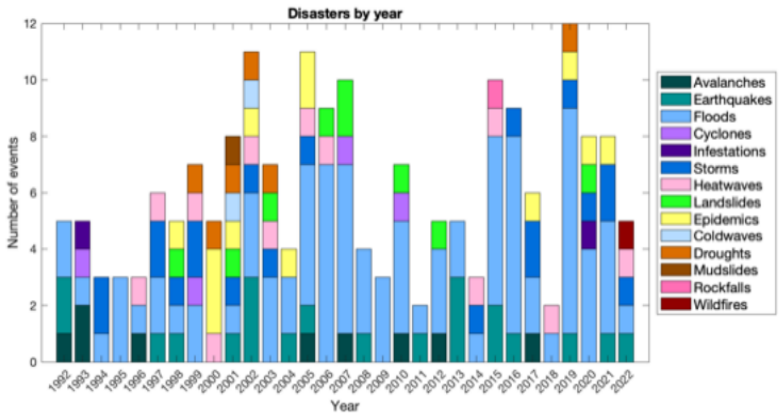
Intense heatwaves affected Sindh, including Karachi, in June 2015 and again in June 2022, impacting major cities like Islamabad, Karachi, and Lahore (DAWE, 2021). Perhaps most dramatically, in 2010 the devastating floods, displaced millions of population and became the reason for the destruction of countless homes, emphasizing the pressing need for resilient housing in Pakistan (Sajjad et al., 2019). The 2022 floods, which flooded one-third of the country, devastated 33 million populations and forced 8 million to relocate, have highlighted this need even more urgently.

These events underscore the critical importance of developing housing that can withstand extreme weather conditions to protect vulnerable populations and ensure long-term sustainability. In order to protect vulnerable people and communities and to maintain long-term sustainability, these incidents highlight how crucial it is to develop housing that can resist severe weather and combat climatic challenges.

Pakistan's diverse climate causes significant challenges for the people. The major cities in Punjab and Sindh have to struggle with intense heat, urban flooding, and the damage caused by constant rainfall. The rising temperatures in summer reach 46°C to 50 °C in Lahore, Multan, and Rawalpindi, making housing communities highly vulnerable to climate change impacts. A large majority of middle-income and lower-income people reside in houses with substandard quality and lack adequate ventilation which results in high heat gain, making their homes highly susceptible. All four of Pakistan's provinces are vulnerable to different aspects of climate change. Almost 185 disasters have been reported in Pakistan in the last thirty years are divided into discrete incidents based on time or location. Figure 1 illustrates the number of disasters that occurred annually between 1992 and 2022. All these recurring disasters have multiple impacts on housing, including structural damage, displacement, and long-term socio-economic instability (Ministry of Climate Change, 2023).

**Figure 1**

*List of disaster events per year in Pakistan from 1992 till 2022.*




*Source: Ministry of Climate Change, 2023.*

The vulnerability of housing infrastructure is further increased in urban regions by uncontrolled expansion and rapid population growth. Many homes are extremely energy inefficient and vulnerable to harsh weather because they are built with substandard building materials and are poorly insulated. Traditional housing frequently falls short in rural areas when it comes to climate-related catastrophe protection, resulting in frequent relocation and loss of livelihoods (Mohaibesh et al., 2021). Pakistan's development and economic advancement are severely hampered by the combined effects of climate change and poor housing infrastructure (Ajani & van der Geest, 2021). All these stressors have a great negative impact on the economic growth and urban development of the country (Lerum Boasson, 2014).

In Pakistan, rising energy demand is accompanied by environmental damage and energy waste. The nation's energy consumption increased at a 4.4% annual compound growth rate between 2015 and 20. The overall CO2 emissions have increased at a rate of 4.49%. Even while Pakistan's carbon footprint (2.18 t-CO2/capita) is still lower than the world average, reliance on non-renewable energy sources and inefficient building designs increase carbon footprints, which exacerbates environmental deterioration (Reall & Impetus Advisory, 2022). Similar to other Asian nations, Pakistan's residential sector is one of the sectors with the largest energy consumption demand. Pakistan's building industry used 14.5 MTOE of energy in 2020, accounting for around 28% of the country's overall energy consumption. As a result, it was responsible for about 21 million tons of CO2 equivalent emissions. This value is projected to increase by about 3.01% annually to over 37 million tons by 2040. Environmental deterioration is exacerbated by inefficient building designs and reliance on non-renewable energy sources, which increase carbon footprints. All these factors are not only accelerating climate change but also increasing housing vulnerabilities by raising energy costs and decreasing indoor comfort. Pakistan must act quickly to build climate-resilient housing in light of the escalating climatic challenges. Vulnerabilities will increase without effective rules and adaptive design, exposing communities and the economy to risk. Sustainability over the long term depends on resilient housing (Qureshi, et al., 2022).

**Table 1**

*Climate-induced Vulnerabilities in Pakistan.*

| Year/Period | Event | Impact on Housing & Economy | Source |
|---|---|---|---|
| 2005 | Earthquake (7.6 magnitude) | Massive destruction of housing infrastructure, displacement of millions | Rehman et al., 2016 |
| 2010 | Mega Floods | 2,000 deaths, 20M affected, $16B in economic losses, severe housing damage | Rehman et al., 2016 |
| 2011-2012 | Consecutive Floods | Agricultural losses, infrastructure damage, increased food insecurity | Rehman et al., 2016 |
| 2005-2013 | Climate-related disasters | 1% of GDP lost annually due to climate-induced catastrophes | EM-DAT, World Bank |
| 2016 | Increased Flooding & GLOFs | Rising incidents of flash floods and glacial lake outbursts damaging settlements | NDMA |

| Year/Period | Event | Impact on Housing & Economy | Source |
|---|---|---|---|
| 2022 | Historic Monsoon Floods | One-third of Pakistan submerged, 1,700+ deaths, 2M+ homes destroyed | World Bank |
| Ongoing | Heatwaves, Droughts, Cyclones | Escalating housing vulnerabilities, loss of livelihoods, urban heat stress | LEAD, 2015 |

*Source: Qureshi, et al., 2022.*

## Pakistan and the Urgent Need for Climate-Resilient Housing

The shift to resilience and sustainability in urban development has gained significant attention in both academic research and practical applications. This shift is driven by the growing recognition of the vulnerabilities that cities face due to rapid urbanization, climate change, and socioeconomic inequalities. The 2013 IPCC Fifth Assessment Report states that, together with hazard and exposure, vulnerability is one of the three main elements driving climate-driven risks (IPCC, 2013). Consequently, vulnerability is therefore considered, although in some previous research (Polsky et al., 2007), to depend on sensitivity, adaptive capacity, and exposure.

Overall, the situation in Pakistan underscores the critical need for comprehensive strategies to develop resilient housing. While addressing the specific challenges brought on by climate change, these solutions must strike a balance between thermal comfort, energy efficiency, and economic viability to get better long-run outcomes (DAWE, 2021). By doing this, Pakistan can improve its ability to endure and bounce back from the negative impacts of climatic events, giving its inhabitants safer and more sustainable living circumstances.

In urban contexts, resilience entails adaptive systems and practices that can absorb, recover, and learn from disruptions, ensuring that cities remain functional and livable (Davoudi et al., 2012). One of the significant strategies involves the establishment of green infrastructure, which not only improves biodiversity and creates recreational areas, but also lessens the effects of extreme weather events (Li et al., 2022).

Adaptation refers to the decisions and actions made to modify a system to maintain its efficiency to function in the face of anticipated stressors, challenges, and unexpected circumstances (Hochrainer-Stigler et al., 2018). Similarly, recent global accords and programs have been instruments that, when used in concert or separately, have had significant effects on how rapidly urbanization and climate change are managed (Ru & Mack-Vergara, 2023).

## Pakistan's Housing Context and Challenges

Economic growth and development are severely hampered by the effects of rising sea levels, more frequent and severe floods and droughts, greater heat and water stress, unequal and unpredictable precipitation, and rising temperatures (Lerum Boasson, 2014). In addition, uncontrolled expansion and fast population increase in cities make housing infrastructure even more vulnerable. Many homes are extremely energy inefficient and vulnerable to harsh weather because they are built with inferior materials and inadequate insulation. In rural areas, traditional housing usually fails to provide sufficient protection from climate-related disasters, leading to recurrent migration and loss of livelihoods (Mohaibesh et al., 2021). The combined consequences of poor housing infrastructure and climate change pose a serious threat to Pakistan's economic progress (Ajani & van der Geest, 2021).

In order to lower energy usage and greenhouse gas emissions, Pakistan is working to improve housing resiliency by using sustainable technology and energy-efficient materials. However, financial limitations, a lack of knowledge, and inadequate enforcement of policies frequently impede the adoption of such initiatives. For example, these

obstacles have hindered the National Disaster Risk Reduction Policy's community-level performance, despite its good intentions (Ajani & van der Geest, 2021). Data regarding Pakistan's climate vulnerabilities and their consequences are compiled in Table 1.

## Results and Discussions

According to predictions, Pakistan will be one of nine countries where over half of the world's population will reside by 2050. This forecast indicates that Pakistan's population, which was anticipated at 230 million in May 2022, will have nearly doubled to 403 million by 2050. In addition, as the population grows without measures to increase the availability of inexpensive, climate-resilient housing, the nation will likely be negatively impacted by the effects of climate change. The fact that Pakistan's population is growing faster than the housing market can currently accommodate is contributing to the problem (Rahman & Salman, 2013).

## Initiatives Taken by Private Sectors

Efforts made by the private sector in Pakistan have advanced climate-smart housing through initiatives such as the incorporation of EDGE technology in the housing sector. EDGE, pioneered by the International Finance Corporation (IFC), facilitates the design and certification of resource-efficient buildings. Developers utilize the EDGE app to strategize energy, water, and embodied material use reductions during construction. EDGE certification, attained through audits by verified auditors, acknowledges projects' commitment to minimizing carbon footprint and optimizing resource consumption in the housing sector. Table 2 provides a clear and concise representation of the EDGE certification levels and their respective requirements.

### Table 2

*Criteria for awarding EDGE Certification in Pakistan*

| Certification Level | Savings Requirements | Award of Certification |
|---|---|---|
| Level 1: EDGE Certified | Includes buildings that cut short energy use, water, and embodied energy by 20% | During the initial and final certification phases |
| Level 2: EDGE Advanced | Includes buildings that cut short energy use, water, and embodied energy by 40% | During the initial and final certification phases |
| Level 3: Net Zero/Carbon-Neutral | Includes the criteria of EDGE Advanced with 100% renewables on-site or off-site or purchased carbon offsets to top off at 100%. It is necessary to account for all energy, including liquid petroleum gas (LPG) and diesel. | Operational data must be submitted at least a year following the final EDGE certification with 75% occupancy. |

*Source: Reall and Impetus Advisory, 2022.*

- The social venture Ansaar Management Company (AMC), established in 2008, focuses on affordable housing in Pakistan. The recent initiatives, taken by AMC are the integration of climate-smart housing, through the launch of Safiya Homes. By guaranteeing notable water and energy savings, it has been declared, Pakistan's first EDGE-certified project. To keep the cost of housing low, AMC efficiently divides the land, keeps aesthetic expenditures low and to make them affordable for people it partners with organizations like Trellis Housing Finance.

- One of the pioneer developers and suppliers of pre-fabricated construction modules in Pakistan is Modulus Tech. Their tiny houses are energy efficient, earthquake resistant, and carbon neutral. These houses can be built rapidly and are affordable and resilient because of their special construction materials, passive design techniques, and solar systems. The cost of these houses is around seventeen lacs rupees (Pakistan Rupee) and their lifespan is 50 years. These houses are accessible to both urban and rural clients because of their minimal assembly time.
- The Aga Khan Development Network includes the Aga Khan Agency for Habitat (AKAH), which aims to enhance climate resilience in the deprived communities of Pakistan. It works with these communities and applies a collaborative approach to address various environmental challenges. Initiatives taken by AKAH, like the Water and Sanitation Improvement Programme (WASIP) and Building and Construction Improvement Programme (BACIP) aim to improve access to clean water, sanitation, and climate-resilient housing. AKAH develops low-income products such as energy-efficient stoves, solar-powered water heaters, and biogas plants to enhance indoor air quality and thermal comfort. Despite challenges in improving existing homes' structural integrity, AKAH has introduced lightweight reinforcements and green building guidelines to mitigate seismic risks (Reall and Impetus Advisory, 2022).

## Government Role in Resilient Housing Development in Pakistan

Taking into account public sector efforts to increase climate resilience, addenda to the Pakistan strengthening codes were developed to protect against seismic events and conserve energy. The 2008 Pakistan Building standards, however, solely addressed the design of multi-story structures; before recently, there were no standards that applied particularly to residential dwelling units. Furthermore, although agencies like LDA, city planning, and development authorities, have included seismic protection in the evaluation standards for new construction, there is still uncertainty regarding the progress made in energy conservation and efficiency because of a lack of coordination and technical capability amongst government departments.

- Although government initiatives like the Pakistan Vision 2025 and the National Climate Change Policy (2012) recognize the significance of climate resilience, there has been little implementation of these policies in the housing sector. Research shows that although some climate-responsive projects have been developed, including flood-resistant housing in Sindh and green architecture programs in major cities, they have not been widely implemented. Furthermore, the adoption of resilient and sustainable housing policies is hampered by fragmented governance, a lack of public awareness, and limited funding (Vision 2025, 2017).
- The 2021 Standardization of Building Codes, Standards, and Specifications for low-income (Affordable) Units was developed by the Pakistan Engineering Council (PEC) and the Naya Pakistan Housing Development Authority (NAPHDA) in an effort to bridge this gap (PEC, 2021). Applying to newly planned affordable housing projects in Pakistan, these construction guidelines uphold established norms and best practices for low-income home design
- Building rules have the objective "to provide for public health and safety by establishing minimum requirements for low-income units to be built in Pakistan with respect to strength, serviceability, durability, and integrity" (PEC, 2021, p. 1). The complete building codes act as a guide for developers, engineers, architects, and other relevant stakeholders engaged in the planning and construction of resilient and affordable housing. The regulations explicitly stipulate that only "conventional and common" industry practices are covered, with "atypical" or "rarely encountered industry practices" purposely left out. This means that discussions

of climate-smart inventions and procedures are still out of the question.

- Promoting climate-resilient housing in Pakistan is severely hampered by the government's slow action to create a strong regulatory framework. As previously mentioned, there hasn't been much work done to guarantee that the laws and rules required to encourage climate-smart building practices exist. Climate-resilient housing is still not given much attention in the public sector, which restricts its widespread adoption in the absence of clear regulations and enforcement systems. Urgent policy-level measures that incorporate resilience techniques into local and national housing policies are necessary to close this gap and ensure long-term sustainability and climate adaptation. Communities in Pakistan are more susceptible to future climate-related disasters because the country falls behind other countries in incorporating climate risk assessments into urban building planning.

## Conclusions and Recommendations

Building climate-resilient housing must receive immediate attention due to the growing challenges posed by climate change, especially in vulnerable regions like Pakistan. Based on the literature review, the study highlights the importance of resilience in housing to reduce the adverse effects of extreme weather like flooding, and heat waves which is adversely impacting the quality of life. These findings suggest that the housing sector of our country is extremely vulnerable due to inadequate infrastructure, old building techniques, and inadequate policy implementation and execution. Pakistan's housing policy still lacks international practices such as sustainable construction materials, energy-efficient designs, and climate adaptive planning in the housing industry.

A multifaceted strategy is required to overcome these obstacles. The key components of this strategy are raising public awareness, making major interventions in housing policy, and innovative building methods. Key components for useful and sustainable development are energy efficiency, socioeconomic viability, structural integrity, and climate adaptability. Cooperation between private and public developers, government agencies, and local communities is pivotal in adopting a sustainable housing solution. In conclusion, switching from conventional housing to climate-resilient housing is crucial for Pakistani communities' long-term sustainability and safety. Future initiatives must focus on closing the gaps between policy and practices, supporting environment-friendly urban growth, and funding for research-based solutions that are tailored for Pakistan's climatic circumstances.

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