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# Resilient architecture: A sustainable approach to rebuilding low-cost community shelters in flash flood-prone areas

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**Abstract**

*Pakistan and India have been severely impacted by natural disasters, causing widespread damage to homes and infrastructure and leaving whole communities and individuals vulnerable. Global warming, deforestation, limited government support, and poor infrastructure have increased the vulnerability of populations in hazard-prone locations. This research explores resilient architecture in flash flood-prone regions, with a specific focus on low-cost shelter reconstruction using easily available local materials like lime, mud, earth, and bamboo. Through an in-depth literature review and the analysis of two case studies from Pakistan and India in their relevant context, the study identifies key performance parameters such as form, material, raised platforms, services, and structure. The findings highlight commonalities and differences in performance parameters between the two cases. Both cases excel in achieving resilient architecture, incorporating traditional approaches, post-disaster reconstruction, community participation, women's economic empowerment, raised platforms, and enhanced cross-bracing techniques. The research aims to contribute valuable insights and practical recommendations for sustainable and cost-effective solutions, aiding in the reconstruction of communities affected by flash floods. The suggested pragmatic guidelines, rooted in engaging communities, utilizing sustainable materials, employing traditional methods, and implementing educational programs, offer a tangible roadmap for efficient and cost-effective solutions. Embracing these insights enables policymakers, communities, and stakeholders to actively participate in the revitalization of regions impacted by flash floods, nurturing resilience and sustainable growth in the aftermath of natural disasters. This research stands as a valuable resource for propelling practices that harmonize with the environment and empower communities to not only rebuild but also thrive.*

**Keywords**

*Resilient Architecture, Flash Flood, Low-cost, Sustainable materials, Pakistan, India*

## Introduction

Long-term development of nations like Pakistan and India requires research on natural hazards, as these countries are prone to terrible natural catastrophes on a regular basis (Bobrowsky, 2013). Due to embankment openings, spillovers, and intense rainfall, floods can take hours or can come unexpectedly and without any prior notice. Pakistan and India are mostly affected by flash floods, which occur six hours after the start of heavy rainfall and are often accompanied by cloudbursts, storms, and cyclones (Ali, 2013). Flash floods commonly cause loss of lives, property, and infrastructure, such as dwellings, bridges, and highways. The ground has become infertile owing to erosion of the upper layers of the earth, resulting in a lack of food and animal fodder, and the entire living system has been damaged within hours (Bird, 2022).

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The challenges faced by affected communities are likely to be exacerbated by the impacts of climate change. Extreme weather events will impact low-income communities more severely, as many of these built environments lack resilience strategies to cope with them. Water is the basic imperative for enabling life during natural disasters. By bolstering this critical aspect, low-income communities can better endure the challenges posed by natural disasters and improve their prospects for recovery and rebuilding (Thomas, 2017; Watson & Adams, 2012).

Resilience has emerged as a pivotal subject of academic discourse and a global concern for numerous decades, aligned with the escalating realization and acknowledgment that the world, along with its inhabitants, remains susceptible to shifts in climate and demographics (Dupre & Bischeri, 2020). The essence of resilience is often defined as "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, and identity" (Walker et al., 2004).

Climate change is not a primary threat to natural resources and livelihoods; changes in resource flows caused by climate change have an impact on the viability of livelihoods unless effective measures are taken to protect and diversify them via adaptability and sustainability methods (Boulter et al., 2013). Although the majority parts of Pakistan and India are living below the poverty line, rebuilding shelters in disaster zones can only be done when the nation has the resources to address the dire situation (Khayyam & Noureen, 2020).

The government and non-government organizations (NGOs) have played a proactive role in delivering help to the affected, but it arrived considerably later than expected.

Prevention should be considered before consequences and resilient structures that are affordable to the locals (Shah et al., 2018). This paper explores the sustainable architecture of Flash Flood-prone areas in Pakistan and India as a response to rebuilding low-cost, resilient shelters. In addition, the research identifies the properties of sustainable materials that enable structures to be efficient, durable, and resilient to Flash Floods.

Local construction materials, such as bamboo, mud, and lime, have a huge influence on people's lives. Due to their special characteristics, these materials are strong, long-lasting, environmentally friendly, and resilient to Flash floods. In Pakistan and India's situation, the widespread use of environmentally friendly building materials enables residents to build their own homes using a self-help approach, fostering a sense of pride and ownership. Moreover, through an in-depth literature review and the analysis of two case studies from Pakistan and India in their relevant context, the study identifies key performance parameters such as form, material, raised platforms, services, and structure. The findings highlight commonalities and differences in performance parameters between the two cases. Both cases excel in achieving resilient architecture, incorporating traditional approaches, post-disaster reconstruction, community participation, women's economic empowerment, raised platforms, and enhanced cross-bracing techniques. The following objectives are considered in proposing this research paper.

- To study traditional techniques and practices that can be employed in the construction of low-cost and resilient shelters in flash flood-prone areas of Pakistan and India.
- To analyze two case studies from Pakistan and India for the assessment of identifying key performance parameters for attaining low-cost community shelters in flash flood-prone areas.
- The research aims to contribute valuable insights and practical recommendations for sustainable and cost-effective solutions, aiding in the reconstruction of communities affected by flash floods in Pakistan and India.

## Materials and Methods

The research employs a comprehensive methodology to investigate sustainable architecture for rebuilding communities impacted by natural disasters, particularly focusing on flash floods. A literature review is conducted, drawing insights from various sources like books, conference papers, peer-reviewed journals, and articles to examine traditional techniques for constructing low-cost, resilient shelters. The study also includes the analysis of two case studies from Pakistan and India within a relevant context, exploring key performance parameters related to form, material, raised platform, services, and structure. The findings demonstrate that all two cases have excelled in attaining resilient architecture, considering traditional approaches, post-disaster reconstruction, community participation, women's economic empowerment, raised platforms, and enhanced cross-bracing techniques. The study aims to contribute valuable insights into the development of sustainable and cost-effective solutions for rebuilding communities affected by flash floods, offering practical recommendations for resilient architecture initiatives.

## Literature Review

Pakistan and India, as South Asian nations, possess diverse natural and built environments, and a significant number of individuals are directly impacted by flash floods every year (NRSC, 2020). This diversity makes these countries the guardians of their natural resources, but it also presents a challenge and concern as it can lead to various natural disasters, such as flash floods and earthquakes (Hyndman & Hyndman, 2017). Pakistan and India, situated in South Asia, are neighboring countries with shared borders. Positioned to the west of India, Pakistan boasts diverse geography, including mountains and a coastline along the Arabian Sea. Meanwhile, India, located to the east of Pakistan, shares borders with multiple countries and exhibits diverse geography, including the Himalayas, plains, and an extensive coastline along the Indian Ocean (*South Asia Political Map*, 2018).

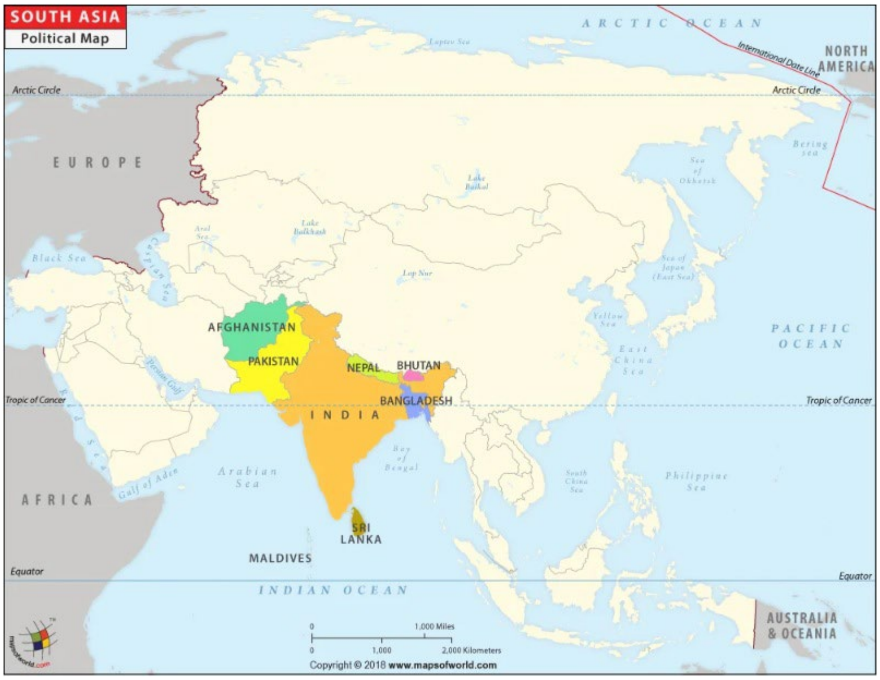


**Figure 1**. Geographical location of South Asian countries (MAPS OF WORLD)

Most of the parts are rural agricultural areas where farmers grow crops, including cotton, wheat, sugarcane, and fruit crops. These flood zones are the most impoverished in the country due to restricted access to essential facilities such as markets, healthcare, and education. From 2010 to 2012, monsoon flooding in Pakistan caused significant losses (Tariq & van de Giesen, 2012). It was reported that over 20 million people were impacted by the flash flood in Pakistan's southern provinces of Sindh, Baluchistan, and Punjab (Yule & Ng-Tatam, 2011).

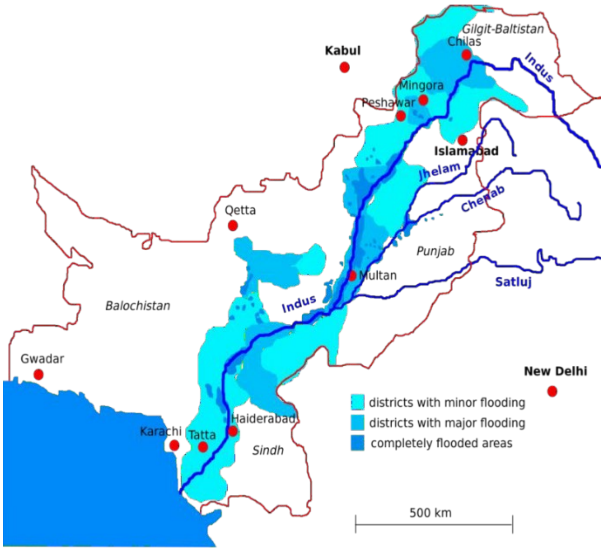


**Figure 2.** Flash Flood in Pakistan (Pakistan Meteorological Department)

Recent flooding events in Pakistan and India (Rannard, 2022) have vividly demonstrated the growing impacts of climate change and the lack of resilience in built environments around the globe. Notably, the recent flooding in Pakistan severely affected over 33 million individuals across the provinces of Sindh, Balochistan, Khyber Pakhtunkhwa, Gilgit Baltistan, and Punjab. The cumulative toll of these floods has resulted in a staggering count of 1,343 reported fatalities and 12,720 injuries. The destruction caused is extensive, encompassing approximately 6,579 kilometers of roads, 246 bridges, and nearly 1.7 million houses (DTM Pakistan, 2022).

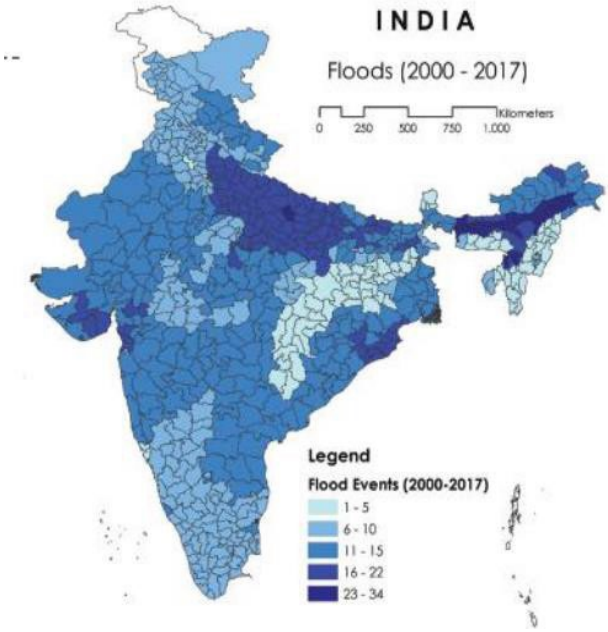


**Figure 3.** Flash Flood in India (SEEDs India)

From 2000 to 2017, India’s Northeast and the Himalayan areas (Assam, Bihar, Gujarat, and West Bengal) were devastated by the monsoon season, and more than 15 million were reported to have been impacted by the Flash Flood (Nkala et al., 2017; SEEDS et al., 2020). Flash flooding may have a broad range of varying impacts on populations. This impact includes the destruction of property, disruption of the economy, and effects on human health, including the possibility of fatalities, serious injuries, and disease epidemics (Minucci et al., 2016). Infrastructure that had been poorly constructed was destroyed, such as dams, retaining walls, waterways, and irrigation routes. The loss of animals and crops was another impact of Flash flooding (*see* Figure 4). Homes were devastated, and the foundations failed to sustain the building as the roof collapsed. As a result of insufficient resources, the majority of the families without hope were left regardless of getting aid. During the flooding, the families fled, but they later returned and rebuilt their homes despite losing everything (Nakanishi, 2023).

**Figure 4.** Displacement During Flash Flood (World ASIA, GULF NEWS)

Bamboo, mud, soil, and lime are examples of sustainable materials that nature has gifted across the world to develop low-cost architecture. There is relatively less processing time required because these materials have been utilized for several years in Pakistan and India. Utilizing these materials has minimal environmental impacts and benefits such as economic effectiveness, thermal heat control, sound absorption, and ease of manufacturing. About 30% of the world's population still resides in mud brick and bamboo construction, which have been used to build low-cost shelters for thousands of years (Li et al., 2020). The bamboo and mud building has the following properties:

**Table 1**. Flash Flood Materials Properties

| | |
|---|---|
| **Stability** | The use of bamboo is helpful for retaining stability and flexibility in flash floods (Chen et al., 2020). |
| **Insects' resistance** | Because mud and bamboo are homes for little insects, the resistance against insects is low. This could be a weakness, but many solutions, including medications and sprays, have been supported to address this issue. |
| **Economic factors** | Building homes using mud and bamboo is affordable, which is good for the populace. |
| **Flash Flood resistance** | Mud and bamboo have been used to defend against flash flood resistance. The term "resistance" refers to the ability of individuals to reconstruct their homes at a reasonable cost after suffering damage from various natural catastrophes (Chowdhooree & Das, 2022). |
| **Special characteristic** | People can build their own homes as a means of personal growth. Mud and bamboo are readily available and inexpensive, making it easier for victims and those in need to construct them. |
| **Experience required** | To build these dwellings, no expert labor is required. For example, a man who understands the many varieties of bamboo and mud may build a house with his own hands. Consequently, a person should possess fundamental abilities. |
| **Rain resistance** | Rain resistance ranges from low to medium. Rainwater penetrates the home and wets the mud and bamboo. In dwellings, there is no suitable roofing. However, because of alternate floors, individuals may live in the rain for a long. |

Hydraulic lime has maintained stable under water for several months in flood-prone regions of Pakistan (*see* Figure 8). When there is flooding, lime often takes on various shapes, preventing the flood from spreading. Lime has become widely recognized as a conservative substance not just in South Asia but also around the world (Ventolà et al., 2013). Due to its ability to absorb carbon dioxide, one of its most significant benefits is its improvement of health and hygiene (Holmes & Rowan, 2015). In comparison to solid materials (hard cement and masonry, this creates a more pleasant atmosphere by reducing surface condensation and molding development. There are the following Lime characteristics against solid materials.

**Table 2**. Lime Qualities with Hard Cement and Masonry

| LIME | HARD CEMENT AND MASONRY |
|---|---|
| • **Do not allow dampness.**<br>They allow buildings to breathe by allowing vapor to pass through. This reduces the chance of absorbing moisture and protects the building fabric from harm.<br><br>**Figure 5.** Do Not Allow Dampness. | • **Allow dampness.**<br>Hard cement and masonry surfaces make it challenging for moisture that is constantly absorbed into the structure to evaporate. This can cause moisture, condensation, peeling paint, higher heating expenses, and wetness on both internal and external walls.<br><br>**Figure 6.** Damped Wall. |
| • **Gives a comfortable environment.**<br>Permeable and open-textured materials absorb and release moisture to stabilize a building's internal humidity, reducing surface condensation and mold formation (Weissman & Bryce, 2015). | • **Less comfortable environment.**<br>Traditional solid-wall construction is the most difficult and typically the least affordable building feature to insulate. |
| • **Benefits of ecology**<br>Compared to cement, lime needs less energy.<br>Lime absorbs carbon dioxide.<br>It is possible to make lime on a small scale.<br>Perfect binder.<br>Clay soils may be stabilized with relatively little quicklime.<br>The structure is protected by small amounts of lime. | • **Fewer benefits of ecology**<br>The environmental impact of concrete, as well as its preparation and application, is complicated.<br>The cement manufacturing sector is a large source of CO2, a major greenhouse emission.<br>The concrete flow is employed to add to the levels of soil erosion, water pollution, and floods in order to build hard surfaces.<br>Demolition and concrete dust can be important sources of harmful air pollution. |
| • Become a shield to materials around.<br>• Functional.<br>• Less healing time.<br>• Easy to handle. | • Less shield to material around.<br>• Deformation/ deterioration.<br>• Long healing time.<br>• Difficult to handle. |

Flash Flood relief shelters have been developed with a focus on vernacular construction skills, resulting in building designs that have a lower carbon footprint and can be easily constructed by those in need.

## Examples in Pakistan

### *The Home: Straw Bale Houses, Pakistan*

Pakistan Straw Bale and Appropriate Building (or PAKSBAB) employs indigenous and renewable materials to construct flood-resistant and energy-efficient dwellings. The properties are also cost-effective and load-bearing designs, with straw bale walls supporting the roof load and allowing the structure to withstand severe winds and flood pressure.


**Figure 7.** Image, Protection from Lime (Recovery and Resilience After Floods in Pakistan, 2011)

In order to increase the tensile strength of mud bricks, women have been practicing utilizing fibrous materials like straw to construct their dwellings. The use of mud bricks in buildings reflects both the formation of national cultural pride and the predominance of human values (*see* Figure 8).

**Figure 8.** Construction with Mud (Heritage Foundation of Pakistan)

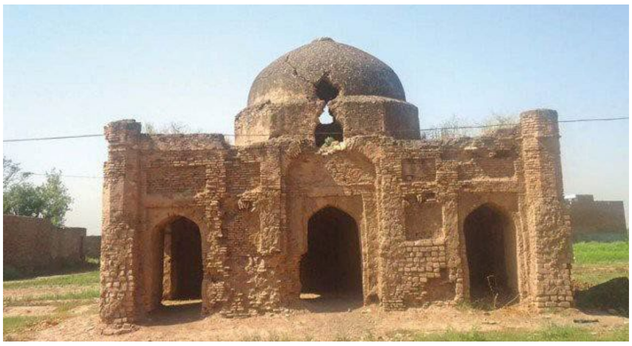

**Figure 9.** Construction with Mud and Lime (Mughal Heritage 17th Century, 2015

The building was made of lime mud brick. The structure is coated with lime and mud to preserve the building. Despite several Flash Floods, this structure has remained preserved (*see* Figure 9).

## Case Studies

The two resilient shelters of different countries, such as Pakistan and India, have been selected to analyze as case studies for the assessment of attaining sustainable, low-cost structures. These projects have contributed to the resilience of communities facing such disasters and have effectively integrated objectives such as economic growth, community development, and relationship building in a creative and contextually appropriate manner (Pelling, 2003).

### *Women's Centre, Pakistan*

Architect Yasmeen Lari designed the Women's Centre in Darya Khan Shaikh, Sindh, in 2010. This initiative was designed with the intention of empowering women, creating a role model environment where they may support their families during hard times, and potentially enhancing their financial situations.

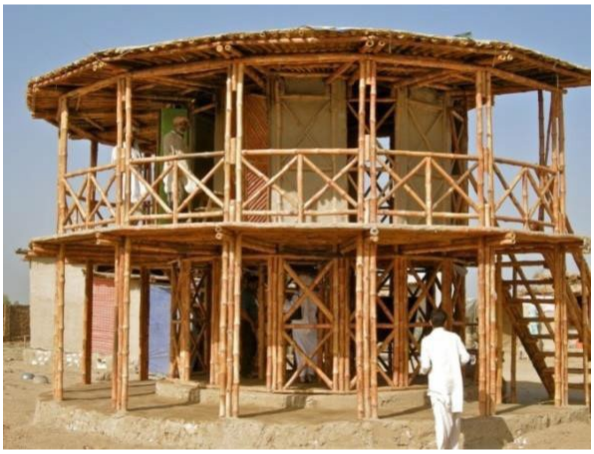

**Figure 10.** Image, Women Centre (TMA Darya Khan **|** PAKWORKERS)

The two-story floating bamboo structure has been designed to protect them from flooding, where women could utilize their abilities to grow vegetables and watch youngsters playing outside. This initiative has been guided toward activities that would generate income. This raised building form has been a source of pride throughout the Flash Floods.

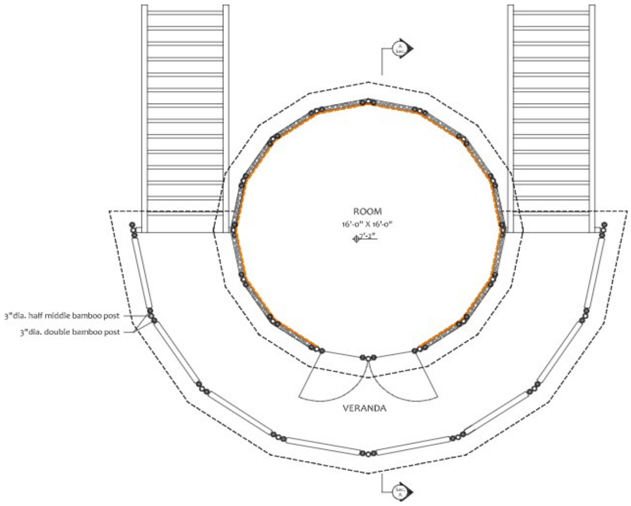


**Figure 11.** Architectural Plan (Arch Daily Vernacular Architecture)

### *Form*

Women's Centre is circular in form, allowing for good air dispersion and enough closet space. This circular design uses less material to construct than a rectangular design. It is structurally stronger than a rectangular enclosure and has low wind resistance. The veranda has served as a porch or gallery, allowing a person to sit comfortably (*see* Figure 12).

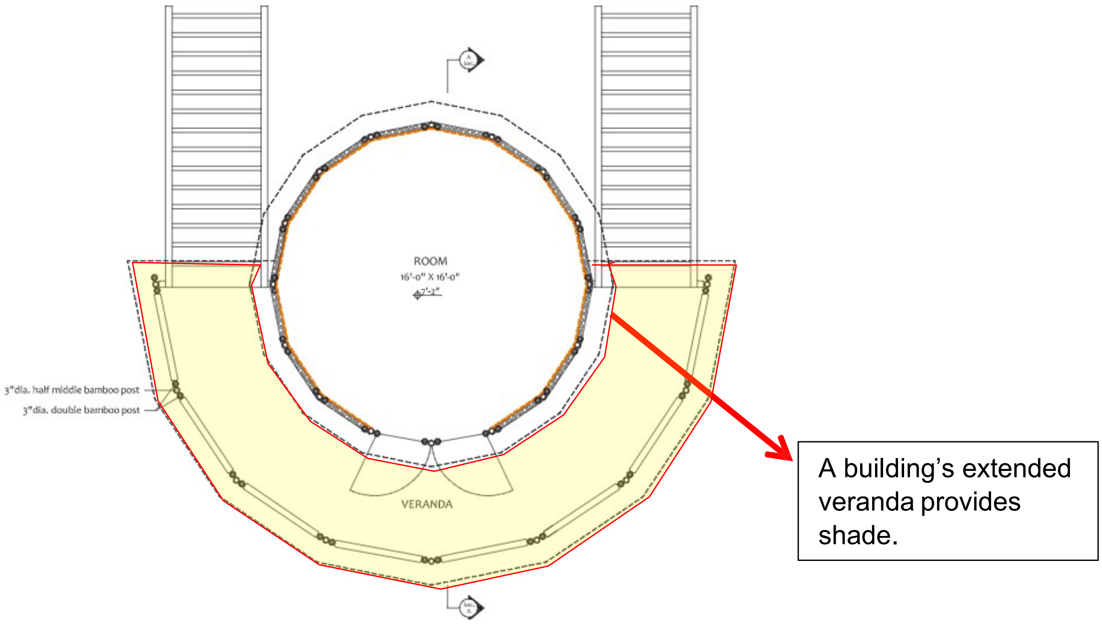


**Figure 12.** Veranda Feature

### *Material*

This construction approach has employed low-carbon emitting materials such as bamboo, lime, and mud. The use of bamboo as a building material has been prevalent for a long time, and it has the potential to be environmentally sustainable.

### *Raised Platform*

A raised platform has been designed to protect the building from flooding. The elevated floors have helped to keep individuals out of dangerous situations.

**Figure 13.** Raised Floor*Services*

The building's construction materials have a significant impact on the building's long-term energy expenses. Women's Centre uses energy-saving materials to minimize the quantity of energy generated. The raised structure has enough proper cross ventilation (*see* Figure 14).

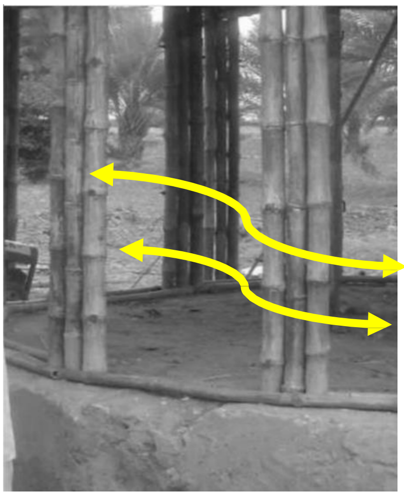

**Figure 14.** Cross Ventilation

*Structure*

A braced system has been promoted in this project and has the ability to support the weight of the roof (*see* Figure 15).

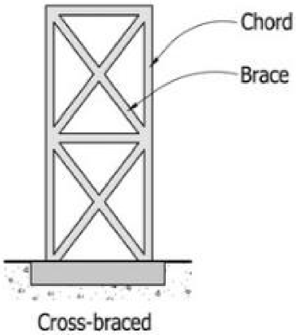


**Figure 15.** Cross Bracing

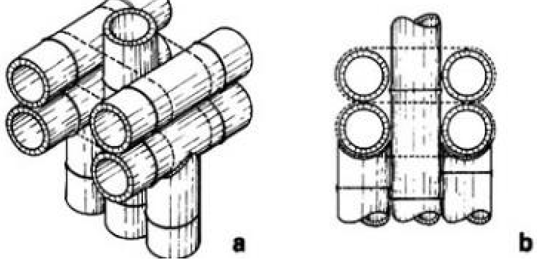


**Figure 16.** Bamboo Double Post

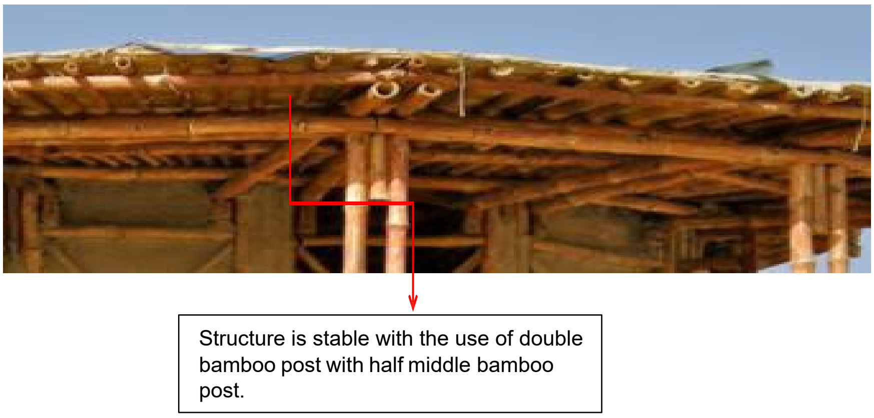


**Figure 17.** Roof

Cross bracing, which has integrated two diagonal pieces in an X form to construct wall trusses, can be used in any framework (*see* Figure 17). Bamboo or wood slats are used to divide the top row from the bottom row so that the upper bamboos do not slip over the lower. The methods have been employed in this project to increase a building's capacity to withstand flooding. Poor drainage can lead to structural problems, so a sloping roof was chosen for this project (*see* Figure 18).

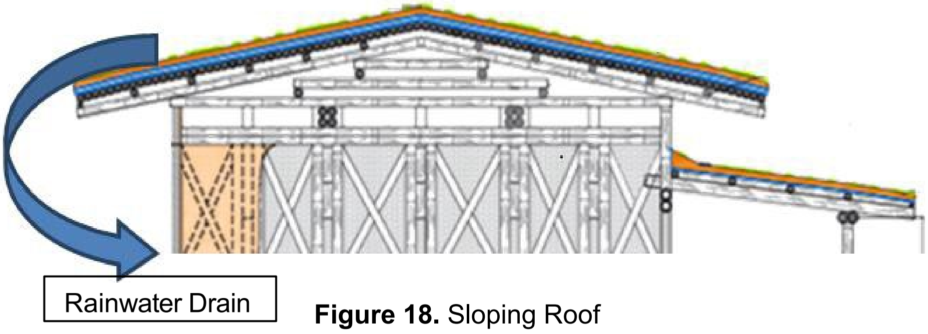


**Figure 18.** Sloping Roof

### *Bamboo House in India*

Architect Kamal Chawaa, with the collaboration of SEEDs (Firm), constructed 80 bamboo dwellings in Assam, India, as a response to flash floods in 2018. The project was designed as an example of modern vernacular architecture with the goal of fostering resilient communities via participatory design.

**Figure 19.** Bamboo House (SEEDs)

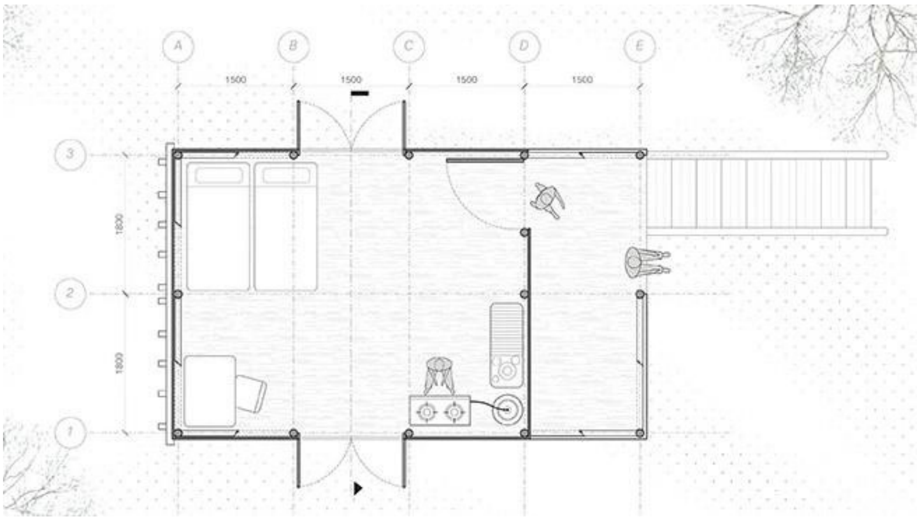

**Figure 20.** Architectural Plan (SEEDs)

#### *Form*

The bamboo house is rectangular in shape, and its layout is multifunctional, complementing the local community's way of life. A team of architects has collaborated with local people to create a hybrid dwelling design that combines contemporary technologies with local traditional architecture.

*Material*

Bamboo, lime, and mud have been used in this project to address the concerns of climate change and carbon footprint. Modifications have been made to improve the traditional building elements, such as deeper bamboo foundations covered with a lime mixture for the purpose of withstanding floods.

*Raised Platform*

The platforms have been highly raised to allow for daily activities like weaving, livestock raising, boat storage, and play areas for kids.

**Figure 21.** Playing Area for Kids (Designboom)

*Services*

The semi-open veranda space has offered for social interaction and food preparation. Compared to standard designs, this project's construction costs were up to 10 to 15% lower, making it economically feasible.

**Figure 22.** Semi-open Space (Designboom)

### *Structure*

Bamboo crossing bracing has been promoted in this project. Indigenous binding methods using rattan and bamboo dowels have been used to make the building resilient to lateral forces during floods.

**Figure 23.** Assembling Cross Bracing (SEEDs)

The following Table 3 shows the common and different features of two selected projects in the context of the resilient architecture of Flash Flood-prone areas of Pakistan and India.

**Table 3**. Common and Different Features of Two Case Studies

| Elements | Women Centre, Pakistan | Bamboo House, India |
|---|---|---|
| **Platform** | Raised platform with earth blocks, mud, lime and bamboo | Raised platform with mud, bamboo, and concrete |
| **Materials** | Use stone, bamboo, mud, lime | Use mud, stone, and bamboo |
| **Services** | Offers energy-efficient services | Offers energy-efficient services |
| **Technology** | Employs local technology | Employs local and latest technology |
| **Structure** | Use cross bracing | Use cross bracing |
| **Access** | Offers access from stairs | Offers access from stairs |
| **Form** | Circular | Rectangular |

## Results and Discussions

### *Traditional Approach*

The results of the study indicate that sustainable, low-cost solutions for Flash flood-affected areas have been achieved through the architecture of the two case studies in Pakistan and India, utilizing traditional materials such as bamboo, lime, earth, and mud. These environmentally friendly materials have a minimal carbon footprint and are found in Pakistan and India. Using them as construction material is a sustainable approach and ecologically beneficial. Two cases are traditional and cost-effective, and they promote basic building techniques that can be used to build high-quality, resilient structures, which can save expenses and enhance security.

### *Post-disaster Reconstruction*

The results of the study show that two case studies have successfully withstood two flooding seasons post-construction, highlighting the effectiveness of combining indigenous knowledge with modern building methods, especially in disaster-resilient community design. The integration of traditional techniques with post-disaster rehabilitation has resulted in a resilient built environment. The use of locally produced materials has also boosted the economy by creating employment opportunities and meeting essential needs. Architects, urban planners, and engineers must invest significant effort in post-disaster reconstruction efforts. They should focus on utilizing the best natural resources available to them to respond to flood-prone areas.

### *Community Participation*

Results show that the locals in both case studies have been trained by architects and engineers to rebuild their homes with minimal resources and take safety measures in the face of emergencies and disasters. Workshops were conducted not only to educate the participants but also to interact with the community to effect change in their living conditions. These workshops aimed to promote community participation in rebuilding efforts and raise awareness about sustainable and disaster-resilient construction practices. The success of these workshops is reflected in the fact that the communities were able to withstand subsequent flooding seasons after construction, demonstrating the effectiveness of combining local knowledge and modern building methods (Jamshed et al., 2018). Their involvement with rural youngsters has not only made an imprint on the young brains but has also sparked change in the community.

**Figure 24.** Participatory Approach, Pakistan (Heritage Foundation of Pakistan)

**Figure 25.** Participatory Approach, India (INHABITAT, India)

### *Women's Economic Empowerment*

The results of the research indicate that women have been trained in various skills to improve their household income in the two case studies. Additionally, community centers such as women's centers, schools, and dispensaries have been designed to empower women and enhance their social, economic, and financial status through a sustainable approach. This demonstrates the importance of including women in the rebuilding process and creating spaces that prioritize their needs and well-being. Such initiatives not only contribute to community development but also promote gender equality and women's empowerment (*see* Figure 26).

**Figure 26.** School (Heritage Foundation of Pakistan)

### *Raised Platform*

The two case studies have incorporated raised platforms as a solution to protect the structures from floods, reinforcing their foundation and structure. This approach is crucial in hazard-prone locations where the development of raised platforms is necessary to provide human protection, secure assets, and protect food, water sources, and livestock from flood damage (*see* Figure 27). During floods, extra food must be protected from being washed away or ruined, and grain must be kept safe from excess water by raising the basement above the ground level. (*see* Figure 26).

**Figure 27.** Raised Floor for Food (Heritage Foundation of Pakistan)

**Figure 28.** Raised Floor for Animals

### *Enhance Cross-Bracing Techniques*

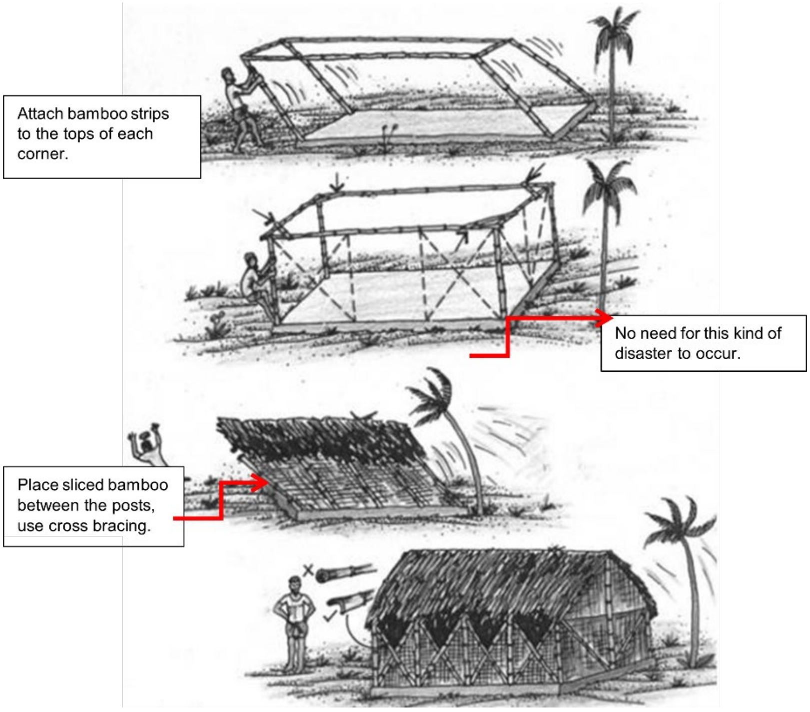


**Figure 29.** Enhance Cross Bracing Techniques

The results of this study show that cross-bracing techniques utilizing bamboo material have been employed in two case studies to minimize destruction. These techniques enhance the ability of a structure to withstand Flash Flood events. Overall, a cross-braced system can be an effective way to improve the structural integrity and stability of a building, especially in situations where heavy loads or external forces are a concern.

**Table 4**. Practical Recommendations

| **Recommendation** | **Implementation Approach** |
|---|---|
| Community Engagement and Participation: | Encourage active involvement of the community in both the design and construction phases, ensuring incorporation of local insights and needs.<br>Initiate community-led projects to foster a sense of ownership and pride in the reconstruction process. |
| Utilization of Sustainable Materials | Advocate for the widespread adoption of eco-friendly building materials such as bamboo, mud, lime, and earth.<br>Conduct awareness campaigns to educate communities about the advantages of sustainable materials for constructing durable and resilient structures. |
| Traditional Techniques and Practices: | Integrate proven traditional construction techniques and practices that align with the local context.<br>Organize workshops and training sessions to transfer traditional knowledge to local builders and communities. |
| Post-Disaster Reconstruction Planning: | Develop comprehensive plans for post-disaster reconstruction that incorporate principles of resilient architecture.<br>Establish rapid-response teams and allocate resources for immediate initiation of reconstruction following a flash flood. |
| Women's Economic Empowerment: | Implement programs empowering women in construction and decision-making processes.<br>Offer skill development opportunities for women in construction-related activities, contributing to their economic empowerment. |

**Table 4**. Continue.

| | |
|---|---|
| Educational Initiatives: | Launch educational initiatives on disaster preparedness and resilience at the community level.<br>Integrate sustainable architecture concepts into school curricula to promote awareness from an early age. |
| Monitoring and Evaluation: | Establish a robust monitoring and evaluation system to assess the effectiveness of reconstruction projects.<br>Regularly review and update reconstruction strategies based on lessons learned from previous initiatives. |

By implementing these practical recommendations, sustainable and cost-effective solutions can be realized, contributing to the reconstruction and resilience of communities affected by flash floods in Pakistan and India.

## Conclusion

This research underscores the imperative for resilient architecture in regions of Pakistan and India prone to flash floods, where natural disasters have inflicted severe damage on homes, infrastructure, and entire communities. The heightened vulnerabilities resulting from global warming, deforestation, limited government support, and inadequate infrastructure emphasize the necessity for a strategic rebuilding approach that addresses both immediate needs and long-term sustainability. The study's emphasis on low-cost shelter reconstruction, utilizing sustainable materials such as lime, mud, earth, and bamboo, highlights the potential for eco-friendly building practices. The examination of two case studies sheds light on critical performance parameters, illustrating that resilient architecture, incorporating traditional methods, post-disaster reconstruction, community engagement, women's economic empowerment, raised platforms, and enhanced cross-bracing techniques, is not only feasible but also successful. The proposed practical recommendations, anchored in community involvement, sustainable materials, traditional techniques, and educational initiatives, provide a practical guide for effective and economical solutions. By embracing these insights, policymakers, communities, and stakeholders can contribute to the reconstruction of areas affected by flash floods, fostering resilience and sustainable development in the wake of natural disasters. This research serves as a valuable tool for advancing practices that align with environmental harmony and empower communities to rebuild and flourish.

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