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on

BEYOND AFFORDABLE HOUSING

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Conference Proceedings

BOOK OF PAPERS

PUNJAB HOUSING & TOWN PLANNING AGENCY

Ensuring Smart Affordable & Sustainable Housing

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PUNJAB AFFORDABLE HOUSING PROGRAM

EDITORIAL

KHWAJA SIKANDAR ZISHAN 5
DR MAMUNA IQBAL 6

SESSION 1
REFRAMING GOVERNANCE: POLICY, REGULATION AND INSTITUTIONAL REFORM

KEYNOTE: **From Policy to Practice: Leveraging the 13th World Urban Forum to Drive Inclusive and Sustainable Housing Transformation in Pakistan** - Jawed Ali Khan 7

Beyond Affordability: A Unified Policy Framework for Socio-Spatial Equity Through Service-Linked Tenure and Cross-Subsidized Housing - Ramsha Rehman 9

Beyond Affordability: Informal Densification and the Crisis of Housing Adequacy in Danishabad, Peshawar - Ar. Muhammad Farhan Farhat 25

PANEL 1: Reimagining Housing Policy: Inclusion, Climate Resilience, and Urban Governance 38

SESSION 2
TECHNOLOGICAL AND SYSTEMIC INNOVATION IN HOUSING DELIVERY

Housing and other essential services in times of crisis
Six reflections beyond affordability - Igor Malgrati 42

Decentralized Greywater Reuse in Peri-urban Lahore: Feasibility and Socio-Cultural Acceptance in Charrar Pind - Sadia Saif ur Rehman 47

A BIM-Based IF-TMB for Low-Carbon Construction and Sustainable Materials - Dr. Habib Ullah, Syyed Mansoor Ali Shah 63

From Plot to System: Toward an Ecological Model of Affordability - Sikander Ajam, Zahid Nawaz Ajam 77

PANEL 2: Beyond Pilot Projects: Rethinking Innovation in Scalable Housing Systems in Pakistan 90

SESSION 3
CLIMATE RESPONSIVE HOUSING AND RESILIENT BUILT FORMS

KEYNOTE: **Climate Resilient Development: Lessons, Challenges, and Opportunities from Pakistan** - Dr. Ahmed Ali Gul 95

Toward a Morphology of Resilience: Integrating Ethics, Ecology, and the Green Imperative - for Climate-Responsive Urbanism and Disaster Mitigation in Pakistan - Ar. Farooq Usman Shahid , Ar. Muhammad Zeeshan Zaheer 98

Affordable Housing and the City: Development of a Climate-Responsive Smart Housing Model for a Sustainable Built Environment - Sabahat Alamgir , Arooj Arif 102

PANEL 3: Climate Responsive Housing and Resilient Urban Futures 110

SESSION 4
TECHNOLOGICAL AND SYSTEMIC INNOVATION IN HOUSING DELIVERY

***KEYNOTE*: Accessibility Is Affordability: Induced Traffic and Socio-Spatial Equity in Lahore** - Khurram Shehzad PAS 113

Optionality and Density: Demographic-Driven Housing Typologies for Resilient Urban Growth in Lahore and Comparable Megacities - Ammr Vandal 121

Applying a Housing Quality Assessment Framework for Marginalized Communities
Architectural, Spatial, and Socio-Cultural Insights from Hindu Settlements in Karachi - Hira Qureshi 129

Mangrotha Gharbi – A Case Study: Reframing Architectural Pedagogy Beyond Affordable Housing in Flood-Prone Southern Punjab, Pakistan - Nabah Ali Saad, Shajeea Shuja, Alishba Abid 145

PANEL 4: Housing Beyond Shelter: Social Equity, Inclusion, and Everyday Life 161

CONCLUSIONS 165
CONTRIBUTORS 168

It is a pleasure to present this collection of papers and discussions emerging from the conference, which brought together policymakers, architects, planners, researchers, development practitioners, and academic institutions to engage with some of the most pressing housing and urban challenges facing Pakistan today.

As Pakistan continues to urbanize rapidly, the need for affordable, inclusive, and resilient housing has become more urgent than ever. Housing today cannot be viewed merely as the provision of physical structures. It must be understood as a comprehensive system connected with infrastructure, livelihoods, environmental sustainability, social inclusion, and quality of life. Addressing these interconnected challenges requires collaboration across institutions, disciplines, and sectors.

At PHATA, we remain committed to facilitating affordable housing initiatives that respond to the evolving needs of communities across Punjab. Through policy reform, public–private partnerships, institutional collaboration, and innovative housing programmes, efforts are being made to create more accessible and sustainable housing systems for low- and middle-income groups. At the same time, we recognize that long-term success depends on continued dialogue, research, and collaboration with academic institutions, professional bodies, development partners, and communities themselves.

The discussions presented in this publication reflect an important and timely shift toward integrated approaches to housing and urban development. The conference created valuable opportunities to exchange ideas on climate-responsive planning, resilient infrastructure, technological innovation, governance reforms, housing finance, and socially inclusive development. Equally important, it highlighted the need to move beyond policy frameworks toward effective implementation and scalable solutions.

I would like to appreciate the organizers, contributors, speakers, and participants whose efforts made this conference possible and whose insights have enriched this publication. I hope this booklet serves as a meaningful resource for future policy discussions, research initiatives, and collaborative action toward more equitable, resilient, and sustainable urban futures for Pakistan.

KHAWAJA SIKANDAR ZISHAN
DIRECTOR GENERAL PHATA

It gives me great pleasure to present this book of papers emerging from the conference, which brought together architects, planners, policymakers, researchers, development practitioners, and students to reflect on some of the most urgent housing and urban challenges facing Pakistan today. The conference aimed to create a platform for interdisciplinary dialogue around housing, climate resilience, governance, social equity, and sustainable urban futures.

As Pakistan experiences rapid urbanization, increasing climate vulnerability, and growing pressure on its housing systems, the discussions throughout the conference highlighted that housing can no longer be understood simply as shelter provision. Housing is deeply connected with livelihoods, infrastructure, mobility, environmental systems, governance, and broader questions of dignity, inclusion, and belonging.

One of the most valuable aspects of the conference was the diversity of perspectives brought into conversation. Participants from government institutions, academia, professional practice, and international organizations engaged critically with issues of affordability, resilience, climate adaptation, implementation, and community participation. Across the sessions, there was a strong emphasis on moving "from policy to practice," recognizing that meaningful urban transformation requires not only strong policies, but also effective implementation, institutional collaboration, and long-term planning.

The papers collected in this book reflect emerging conversations around climate-responsive housing, resilient development, social equity, technological innovation, and inclusive urban systems. Together, they demonstrate the importance of collaborative and interdisciplinary approaches in addressing Pakistan's evolving urban realities.

As convener, I would like to sincerely thank all speakers, contributors, partner institutions, organizers, and participants whose engagement made this conference possible. I hope this publication serves not only as a record of the discussions, but also as a resource for future research, policy development, and collaborative action toward more inclusive, resilient, and sustainable urban futures.

DR. MAMUNA IQBAL
EDITOR



THEME: 1

REFRAMING GOVERNANCE: POLICY, REGULATION AND INSTITUTIONAL REFORM

KEYNOTE :

FROM POLICY TO PRACTICE: LEVERAGING THE 13TH WORLD URBAN FORUM TO DRIVE INCLUSIVE AND SUSTAINABLE HOUSING TRANSFORMATION IN PAKISTAN

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For millions of families, a home is not simply a physical structure. It represents security, dignity, stability, and the possibility of a better future. Yet for millions across the developing world, including Pakistan, this aspiration remains beyond reach. Today, we are not gathered here only to discuss housing policies in abstract terms. We are here to reflect on how policies can be translated into real homes, real communities, and meaningful improvements in people's everyday lives. This is precisely why the theme "From Policy to Practice" is so important.

The 13th World Urban Forum offers a critical opportunity to move beyond commitments and toward implementation at scale. Pakistan is currently undergoing rapid urbanization, and within the next two decades, more than half of the country's population is expected to live in cities. At the same time, Pakistan faces a housing deficit of more than 10 million units, with low- and middle-income households being the most affected. However, the challenge is not simply one of quantity. It is equally about affordability, access to finance, serviced land, institutional coordination, and inclusive planning systems capable of responding to contemporary urban realities. Encouragingly, we are now beginning to see a shift from policy intent toward practical implementation, with both federal and provincial governments taking concrete steps to address these housing challenges.

One of the most significant developments in Pakistan's housing sector has been the emergence of large-scale and pilot housing programmes that are generating valuable lessons for future policy and implementation. In Punjab, for example, the Government's Apna Ghar Apni Chat programme represents an important initiative built around mortgage financing and public–private partnership models. The programme demonstrates very clearly that housing finance lies at the centre of affordability. Without access to affordable mortgage systems and financing mechanisms, even modestly priced housing remains inaccessible for a large proportion of households. At the same time, the programme also highlights the importance of public–private partnerships. Governments alone cannot meet the scale of housing demand that currently exists in Pakistan, and therefore the capacity, investment, and operational efficiencies of the private sector become essential for scaling up housing delivery.

The programme also illustrates how targeted subsidies and facilitation mechanisms can unlock housing opportunities for lower- and middle-income groups. Simplified regulatory systems and streamlined access to land further demonstrate how policy reform can accelerate delivery processes that otherwise remain slowed by institutional barriers and procedural delays. Importantly, the lessons emerging from Punjab are not relevant only at the provincial scale; they offer valuable insights for national-level housing reform and for the development of scalable housing systems across the country.

Similarly, Sindh's large-scale housing initiatives, including the 1.2 million housing programme for flood-affected communities and the Benazir Housing Programme, provide another critical set of lessons. These programmes demonstrate that large-scale housing delivery becomes possible when there is strong political commitment, institutional coordination, and clear implementation frameworks. They also show how housing programmes can be linked directly with climate resilience and disaster recovery, ensuring that investments contribute not only to immediate shelter needs but also to long-term environmental sustainability and resilience. Another important lesson emerging from Sindh is the value of community engagement and beneficiary-driven approaches. Housing systems are far more likely to succeed when communities themselves are involved in planning, implementation, and decision-making processes because this creates ownership, transparency, and greater social acceptance.

These practical experiences are now beginning to inform the new National Housing Policy currently being finalized by the Ministry of Housing and Works. The emerging policy framework reflects an important shift toward scalable, market-enabling, and inclusive housing systems. A number of key recommendations are already becoming visible within this framework, including the promotion of mortgage-based housing finance systems for low- and middle-income households, the expansion of public–private partnership models, improved access to serviced land through regulatory reform and better land management, and the introduction of targeted subsidies and credit support mechanisms. The policy also emphasizes stronger coordination between federal, provincial, and local institutions while integrating housing more closely with urban planning, transportation systems, and infrastructure development. Equally important is the recognition that climate resilience and disaster risk reduction must now become embedded directly within housing design and development processes rather than treated as separate concerns.

What is particularly significant is that the conversation is now moving away from fragmented pilot projects toward the development of structured national programmes capable of operating at scale. If Pakistan is truly to move from policy to practice, then the next challenge is not simply to design successful pilot initiatives but to scale up the models that are already demonstrating positive results. This requires expanding successful programmes such as Apna Ghar Apni Chat into broader national frameworks, strengthening housing finance ecosystems through engagement with the banking sector and risk-sharing mechanisms, enabling cities to play a stronger role in land management and planning, and building institutional capacity across all levels of government. At the same time, housing programmes must remain inclusive, transparent, and accessible to the most vulnerable populations.

Scaling up, however, should not be understood as simple replication. Different cities and regions possess different environmental conditions, social realities, and economic structures. The challenge therefore lies in adapting successful models to diverse local contexts while maintaining the principles that made them effective in the first place. This is where partnerships become absolutely essential. Transforming housing systems requires collaboration between governments, private developers, financial institutions, civil society organizations, local communities, and international partners such as UN-Habitat and development agencies. Platforms such as Pakistan's National Urban Forum can play a crucial role in bringing these stakeholders together and translating policy dialogue into coordinated implementation and long-term action.

The 13th World Urban Forum also provides Pakistan with an important opportunity to engage within a global exchange of ideas, practices, and experiences. Around the world, countries are experimenting with innovative housing models ranging from cooperative housing systems and land value capture mechanisms to transit-oriented development and climate-resilient urban planning. By participating in these conversations, Pakistan can both share its own experiences and learn from international best practices in order to refine its own housing strategies and accelerate progress toward more inclusive and sustainable urban futures.

Ultimately, housing is not only about infrastructure or construction. It is about people, opportunity, inclusion, and dignity. The experiences emerging from Punjab's Apna Ghar Apni Chat programme, Sindh's large-scale housing initiatives, and the new National Housing Policy collectively demonstrate that Pakistan is beginning to build meaningful momentum toward implementation and reform. We are learning from practical experience, testing new approaches, and gradually building the foundations necessary for long-term scaling and institutional transformation.

The challenge now is to carry these lessons forward systematically, inclusively, and at scale. Because when housing systems succeed, they do far more than provide shelter alone. They reduce inequality, strengthen resilience, improve access to opportunity, and unlock the social and economic potential of cities themselves. The momentum created through the 13th World Urban Forum therefore offers an opportunity not only to discuss shared commitments, but to transform those commitments into lasting and meaningful change. Because ultimately, when we build homes, we build futures.

PAPER 1:

Beyond Affordability: A Unified Policy Framework for Socio-Spatial Equity Through Service-Linked Tenure and Cross-Subsidized Housing.

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ABSTRACT

Urban housing policy in Punjab is currently characterized by a regulatory bifurcation between the Private Housing Scheme Rules 2022 and the PHATA Affordable Private Housing Scheme Rules 2020 (Revised 2025). This structural divide often produces spatial segregation, where low-income households are either marginalized to peripheral locations or burdened by excessive transit costs that undermine the very notion of affordability.

This study addresses the critical gap between "affordable" and "equitable" housing by proposing a Unified Equitable Housing Policy that integrates working-class communities directly into the socio-economic fabric of private developments. The research employs a mixed-method, exploratory sequential design approach. By combining policy analysis with primary data collected from 150 low-income households in Multan through semi-structured interviews. The study examines regulatory limitations, household priorities, and infrastructural inefficiencies embedded within existing frameworks.

The research advances three interlinked innovations. First, it proposes a Land-Cost Cross-Subsidization Model, aligned with United Nations Sustainable Development Goal 11, in which premiums from high-income plots offset land costs for working-class households within the same development. Second, it introduces the spatial concept of Equidistant Widespread Pockets, ensuring distributed integration of lower-income housing rather than peripheral clustering.

Third, it develops a Service-Linked Tenure mechanism, whereby housing installments are structured through workplace payroll deductions, strengthening payment security while reducing default risk and installment burden.

The framework is grounded in an assessment of low-income households' needs, repayment capacities, and functional roles within the urban housing ecosystem. By reforming infrastructure standards and promoting a Duplex Integration Model, allowing two independent families per plot. The study demonstrates how saleable land area can be optimized while achieving higher densities without the maintenance burdens typical of apartment complexes. Complementary strategies such as communal parking and localized housing clusters further reduce commuting distances, transit costs, and urban carbon emissions.

The findings suggest that urban equity cannot be achieved through price reduction alone. Rather, it requires the structural integration of housing, employment, and infrastructure within a unified regulatory framework. The proposed policy model offers a scalable and sustainable blueprint for inclusive urban development, promoting social cohesion, economic stability, and environmental responsibility.

KEYWORDS:

SDG-11; Affordable Housing; Policy Reforms; Low Income Housing; Socio-Spatial Equity; Inclusive Planning.

INTRODUCTION:

Access to adequate housing remains a pressing global challenge, particularly in developing countries where rapid urbanization, economic inequality, and resource mismanagement intersect. Across the world, sustainable

and affordable housing has emerged as a central theme in discussions on social equity, urban resilience, and inclusive development. However, despite numerous policy frameworks and international commitments, the gap between housing demand and supply continues to widen, especially for low-income populations. This issue is further compounded by structural barriers such as high initial costs, policy inefficiencies, and limited adaptability of housing models to diverse socio-economic contexts (Sohaimi, et al., 2025). n Pakistan, the situation reflects these global challenges but with deeper structural complexities. As the urban poor face simultaneous pressure from food, rent, utilities, transport, health and schooling costs, reducing their food budget (Latif Abdul, 2020). This issue has contributed to the spread of informal settlements and slums. Although various initiatives by the government, NGOs, and public-private partnerships have attempted to address these issues but the commercialization of housing has changed the perspective. Turning a basic necessity to an investment commodity, largely benefitting middle- and upper-income groups (Malik & Nurunnabi, 2024).

At the national level, housing policies have been frequently revised with the aim of addressing the low-income housing deficit. However, these policies often fail to align with actual socio-economic realities. For instance, while regulations (Governmnet of Punjab (Local Government & Community Development Department), 2022) mandate the allocation of 20% of land in private housing schemes for low-income groups. This provision does not correspond to their actual population share, which exceeds 40% in regions like Punjab (Ahsan, 2019). Consequently, a housing backlog of approximately 10 million units continues to grow annually, highlighting systemic inefficiencies in both policy formulation and implementation (Sindhu, 2019).

Additionally, the affordable housing schemes are often located far from employment centers, increasing transportation costs and reducing their attractiveness for low-income residents. Thus, making the affordable schemes unaffordable for the urban poor. As a result, many "affordable" housing units remain either vacant or occupied by tenants while being owned by middle or upper middle class, (Rehman & Naeem, 2017) while slums continue to expand. This indicates that the core issue is not merely the supply of housing but the lack of affordability, accessibility, and equity in its provision (Durr-e-Nayyab, 2022).

This research aligns with the concept of beyond affordability; involving policy innovation with inclusive design/planning to create sustainable urban development. It records the critical disconnect between housing policies and ground realities, particularly the overlooked relationship between food security and housing affordability. The central research problem, therefore, lies in the mismatch between policy provisions and the actual needs of low-income populations, resulting in ineffective housing solutions and continued socio-spatial inequality.

The primary aim of this study is to identify the underlying gaps in existing housing policies and propose a more integrated and equitable framework for affordable housing in Pakistan. The research is guided by the following questions:

1. What are the key policy and implementation gaps hindering effective low-income housing provision?
2. What are the issues faced by the urban poor in securing a house?
3. What strategies can be adopted to develop more inclusive and sustainable housing models?

The paper is structured as follows: the second section reviews the relevant literature and practices in affordable housing area; the third section reviews the existing policy framework and identifies critical gaps; the fourth section discusses the socio-economic dynamics influencing housing accessibility; and the final section proposes recommendations and a conceptual framework for more equitable and sustainable housing development.

2. LITERATURE REVIEW

2.1 EVOLVING PARADIGMS OF AFFORDABLE HOUSING

The concept of affordable housing has undergone significant transformation over time. The Traditional definition of Affordable housing reflects the purely economic perspective of housing, characterized by 30% of the gross monthly income (Sindhu, 2019). The discourse on housing affordability has expanded significantly in recent decades. Evolving from a narrow economic focus to broader social and environmental criteria and quality of life (Farzana, Mahmood, Biswas, & Islam, 2023). Studies stress trade-offs between affordability, accessibility, amenity and adequacy, and the need for intersectional, context-

specific approaches (Wenjie Cai, 2015).

One of the key theoretical contributions to this field is the idea of workplace proximity. Studies indicate that low-income households often prioritize reduced transportation costs over housing quality, (Zafar, Waheed, & Javaid, 2019) (Malik, Roosli, & Tariq, 2019). Apart from transportation cost and locomotion time, the infrastructure cost is a major contributor, in making a peripheral housing schemes economically inefficient despite lower land prices (Budiningtyas & Setyono, 2019).

The concept of self-building has further challenged, the conventional top-down planning approaches by emphasizing community participation and user driven development process. (Georgiadou & Loggia, 2025). This approach has been successfully demonstrated in the Pakistani context through early precedents such as Anguri Bagh Housing Project in Lahore (executed in 1973-1975). Where the Architect engaged future residents of Anguri bagh as key stakeholders in planning and construction. (Yasmeen Lari, 1973). This participatory model resulted in a development that was closely aligned with users' socio-economic needs and spatial preferences.

The principles of community participation were further expanded in the Orangi Pilot Project in Karachi (1980), where residents took primary responsibility for financing and implementing infrastructure improvements, while external agencies provided only technical guidance (Tirmizi, 2006). This initiative demonstrated that low-income communities possess the capacity to self-organize and deliver cost-effective solutions when supported by appropriate institutional frameworks.

Despite the success of participatory models, finance remains the most significant barrier in scalability of affordable housing. Research suggests that affordability gap can be reduced from 20% to 50% through the provision if un-serviced land combined with access to low-interest financing (Khan, Yasin, Akbar, Noor, & Moeed, 2020). Khuda Ki Basti scheme in Hyderabad (1985) exemplifies this approach, where the government provided un-serviced land near a developed area along with flexible financing options (Tirmizi, 2006). The project effectively controlled speculation while addressing affordability and proximity concerns.

Collectively, these precedents reinforce recommendations from contemporary studies advocating for participatory planning processes, public private partnership, and localized regulatory frameworks (Sohaimi, et al., 2025). However, the integration of these emerging paradigms of Affordable Housing, need be examined in the evolution of housing policies of Punjab.

2.2 POLICY REFORMS AND REGULATORY EVOLUTION IN HOUSING DEVELOPMENT

Housing policy in Punjab has undergone a series of regulatory revisions aimed at streamlining development processes and encouraging private sector participation. The current Punjab Private Housing Scheme Rules 2022 (PPHSR-22) build upon earlier frameworks introduced in 2010. While parallel regulations in LDA, as LDA Private Housing Scheme Rules 2014 have evolved independently within their specific jurisdictions. Despite these continuous reforms, the persistence of issues in housing sector, urges a detail study of the existing Housing policies. In this regard a comparison of Punjab Private Housing Scheme Rules 2010 to 2020, highlighting the differences; affecting the affordable housing, is as under:

Feature	2010 Rules	2014 Rules amendment	2022 Rules
Approval Process	Two-stage: Preliminary	**Streamlined:** Planning permission	**Single Stage:** Approval required before any
Objection Timeline	15 days	*Not detailed as changed*	**10 working days**
Appeals Process	30 days to file	*Not detailed as changed*	**90 days** to decide appeal
Classification	Private vs. Farm Housing Schemes	*Not detailed as changed*	**Tiered by Size:** 5 categories (under 40k to 500k+), plus
Land Sub-division	**Separate category** for parcels <100	**Separate category** for parcels <100	**Integrated** into tiered Housing Scheme sizes

"Locked Land" Criteria	Sub-division must be surrounded by	*Not detailed as changed*	Small schemes must be bounded by dev. or
Commercial Area	**Fixed at 5%**	**Flexible:** Permitted to increase beyond	**Tiered:** 5% (<300k), 7% (300–500k), **10%** (500k+)
Open Spaces/Parks	Flat **Min 7%**	*Not detailed as changed*	**Tiered:** 0% (<40k), 5% (40–100k), 7% (100–500k), **10%**
Graveyard Area	Min 2% **inside** the scheme	Min 2% **inside** the housing scheme and	Min 2% (inside or 5km radius if same sponsor); **0%**
Min. Internal Road	30 feet	**20 feet** (for low-cost schemes)	30 feet (Standard); **Tiered Major Roads** (up to 80ft)
Apartment/Social Housing	20% of **plots** for low-income (up to 5	10% area requirement for	**Min 20% residential area** for apartments/small plots

Table 1: Comparison of Punjab Private Housing Scheme Rules from 2010, 2014 and 2020 (Government of the Punjab, Local Government and Community Development Department., 2010), (Lahore Development Authority, 2014) (Government of Punjab (Local Government & Community Development Department), 2022).

From the analysis of the contents of the Table: 1, it is evident that the key shift in policy has been the simplification of administrative procedures aimed at streamlining development processes and encouraging private sector development (Latif Abdul, 2020). The transition from a two-stage approval process to a single-stage system, along with reduced timelines for regulatory feedback, reflects an effort to expedite development approvals. Such measures align with broader policy recommendations regarding, incentivizing developers through procedural efficiency against the provision of 15-20% affordable housing units. (Khan, Yasin, Akbar, Noor, & Moeed, 2020).

Significant changes have also been introduced in the categorization and eligibility of housing schemes. Earlier frameworks distinguished smaller developments under the category of Land Sub-Divisions, often restricted by Land Lock Policy (limiting LSDs around existing developments). Recent revisions have eliminated this distinction, allowing smaller land parcels to be developed as independent housing schemes. While this increases development flexibility, it also enables the proliferation of fragmented developments, including those located away from existing urban infrastructure. This shift raises concerns regarding spatial integration in to urban infrastructure, service provision, and long-term sustainability.

Modifications in land-use allocations further illustrate changing regulatory priorities. The transition from fixed to flexible commercial area allocations offers developer a greater financial viability. Conversely, requirements for open spaces have been reduced or removed for smaller schemes, indicating a trade-off between development efficiency and environmental or social considerations. Similarly, provisions for low-income housing previously tied to smaller plots allocation, have been broadened to include apartment-based solutions while keeping the same right of way requirement. While this introduces typological diversity, it does not inherently ensure convenience of the intended beneficiaries.

Parallel to the general regulations for private housing schemes, the introduction of PHATA Affordable Housing Scheme Rules 2020, represents a targeted attempt to address the housing deficit. A comparison of these two policies highlighting the differences is provided in Table:2.

Feature	PHATA Affordable Rules 2020	Punjab Private Rules 2022
Primary Focus	Participation in **Naya Pakistan Housing Program (NPHP)**.	General regulation for all private, farm, and apartment
Social Housing Quota	**Mandatory 20% area** reserved for NPHP plots/apartments.	**Mandatory 20% residential area** for apartments and/or
Pricing for Quota	Prices for the 20% quota are **fixed by the** PHATA	Prices are determined by the sponsor (market-based)

Min. Application Area	**100 Kanals**. Based on score in Locational	No set minimum; includes schemes of **less than 40**
Classification (Tiers)	Three categories: 100–300k, 300–500k, and >500k.	Five categories based on size, from <40k to 500k+.
Open Space / Parks	**Min 7%** across all sizes.	**Tiered:** 0% (<40k), 5% (40-100k), 7% (100-500k), **10%**
Graveyard Area	**Min 2%** for all sizes.	**0%** for schemes <40k; **Min 2%** for all others.
Commercial Area	Max 5% (up to 500k); **Max 10%** (>500k).	**Tiered:** Max 5% (<300k), Max 7% (300-500k), **Max 10%**
Public Buildings	**2% to 10%** of total area.	**Tiered:** 1% (<40k), 2% (40-300k), **3%** (300k+).
Max. Res. Plot Size	Strictly capped at **1 Kanal**.	Tiered: 10 Marla (<40k) up to **4 Kanal** (500k+).
Min. Internal Road	30 feet (plots up to 5 Marla); **40 feet** (for apartments).	Standard minimum of **30 feet**.
Major Road Width	60ft to 120ft depending on size.	Starts at 30ft for small schemes; **Min 80ft** for
Developer Incentives	**20% to 80% discounts** on fees for reserving extra NPHP area.	Standard approval fees.
Appeal Filing Period	Within **30 days**.	Within **60 days**.
Appeal Decision Time	Within **60 days**.	Within **90 days**.

Table 2: Comparison of PHATA Affordable Housing Scheme Rules 2020 and Punjab Private Housing Scheme Rules 2022 ((PHATA), Punjab Housing and Town Planning Agency, 2020) (Governmnet of Punjab (Local Government & Community Development Department), 2022)

A comparative assessment of these rules suggest that they largely replicate existing planning standards, with limited innovation in addressing affordability constraints. The difference between the two policies majorly lies in the mandate of controlling the cost of affordable Housing, limiting plot size to 1 Kanal and developers incentive tied with provision of additional area for affordable housing units. The list of Affordable Private Housing Schemes (Punjab Housing and Town Planning Agency, 2026) reflects a shift in the development of less than 5 Marla plots with introduction of control mandated at Policy Level. However, the location opted by the developer for Affordable Housing Schemes remained contrary to the concept of proximity.

Scheme Name	Location	Key Details	# of Plots APHS	Distance from city center
Garden Square Villas Eminabad	MouzaKot Bhutta & Chandanian,	134.9 Kanal	103	16 km from Gujranwala
Kingdom Valley	Mouza Choora Chakri Interchange	103 Kanal	3 Marla: 33, 5 Marla: 15	To Rawalpindi, from chakir road
Safia Homes	Bhudla Road District Multan	143 Kanal	3 Marla: 97	10 km to Multan city
Royal Garden Housing Scheme	Mehsm Chowk Kharian Gujrat	237.18 Kanal	3 Marla: 152, 4.13 Marla: 7	To Kharain 27 km, To Gujrat 26 km.
New Depalpur City	Tehsil Depalpur, District Okara	496.65 Kanal	2.89 Marla: 301	To Okara 34.8km, To Depalpur 9.1

Nova City	Mouza Fateh Jang, Attock	970.49 Kanal	2.87 Marla: 211, 4.59 Marla: 339	To Islamabad 40 km
Al-Rasheed Gardens Phase-II	Wazirabad, Gujranwala	236.70 Kanal	4.13 Marla: 74, 4.11 Marla 17, 3 Marla: 14	To Wazirabad 13.5km
Al-Noor Garden Residencia	Bhulair Road, Tehsil Sangla Hill	429.30 Kanal	4.13 Marla: 229	To Faisalabad 47km
Campbellpur Green Attock	Tehsil Hazro District Attock	405.7 Kanals	4.5 Marla: 122, 3.23 Marla: 56	To Attock 12.7km
Prism Town	Tehsil Gujjar Khan, District Rawalpindi	105.14 Kanals	Apartments: 176	To Rawalpindi 43km
Capital Park City Housing Scheme	Tehsil Fateh Jang, District Attock	1426.2 Kanals	3 Marla: 442, 4.13 Marla: 178	To Islamabad 35km, To Fateh
New City Paradise	Tehsil Hassan Abdal, District	4251.40 Kanal	4.59 Marla: 1017, 3.08 Marla: 156, 3.01	From M1 to Rawalpindi 52km,
Minar Housing City	Rakh Hiran Minar Sheikhupura	100.9 Kanal	4.13 Marla: 36, 3 Marla: 22	To Sheikhupura 11.9km
Green Woods Housing Scheme	Mari Jabbar Road, Rawalpindi	156 Kanal	4.59 Marla: 64	To Rawalpindi 35km
Tariq Sharif Smart City	Tehsil Gujar Khan, Rawalpindi	763.4 Kanal	4.5 Marla: 122, 2.8 Marla: 109	47km to Rawalpindi
Blue world Shenzhen City	Tehsil Raiwind, Lahore	662 Kanal	4 Marla: 215	22km to Lahore
New Airport City	Tehsil Fateh Jang, District Attock	801.90 Kanal	4.13 Marla: 298	To Islamabad 40km, To Fateh
National Aerospace City	Makkan Tehsil & District Attock	7440.42 Kanal	5 Marla: 1102, 4.13 Marla:958,	To Attock 12km

Table 3: List of Affordable Housing Schemes Developed Under PHATA Affordable Housing Schemes Rules, (Punjab Housing and Town Planning Agency, 2026).

Subsequent amendments in PHATA regulations, as PHATA Affordable Housing Scheme Rules 2025 introduced a Head of "Special Initiatives" to facilitate foreign funded projects. These "special initiatives" are exempted from the 100-kanal area requirement in Policy. It proposed a revised incentive at a rate of 1% increase in commercial area against 1% increase in the affordable housing area to a maximum of 30% commercial area (Punjab Housing and Town planning Agency, 2025). Incentives linked to higher proportions of affordable housing and flexible commercial allocations reflect an effort to balance financial viability with social objectives.

However, while regulatory reforms focused on facilitating development processes, the financial capacity of end-users remained unaddressed. Evidence from existing low-income housing schemes indicates that monthly installments are often misaligned with household incomes, rendering formally "affordable" units inaccessible in practice (Tirmizi, 2006) (Malik, 2023). Previous studies recommend extending housing loan tenures to 15–20 years to improve repayment feasibility (Malik, 2023).

In response, initiatives were introduced to expand access to housing finance for low- and middle-income groups i.e. Apni chat Apna Ghar, Wazir e Azam Apna Ghar program, Mera Pakistan Mera Ghra, Etc. (Government of the Punjab, n.d.) (Wazir-e-Azam Apna Ghar Program, n.d.) Nevertheless, the effectiveness of such measures remains dependent on their integration with broader planning and policy frameworks that account for income variability and long-term affordability.

3. METHODOLOGY

The study employs a mixed-method approach that combines qualitative and quantitative methods to explore the research question. This approach integrates Exploratory Sequential Design where qualitative insights inform and guide subsequent quantitative inquiry (Mesyitahsyare & Hermina, 2025). It involves identification of key variables qualitatively and then validating them through structured data collection. This two-phase research design is regarded suitable to address complex socio-spatial issues, capturing both structural constraints and lived experiences, enabling a more holistic understanding of affordability (Creswell & Clark, 2018).

3.1 RESEARCH DESIGN

The research is structured in two phases:

3.1.1 QUALITATIVE (SECONDARY DATA ANALYSIS):

In the initial phase, a methodical review of the secondary data was conducted. This included published academic literature on affordable housing, reports on existing housing schemes, notable case studies and policy documents such as the Punjab Private Housing Scheme Rules (2010–2022) and PHATA Affordable Housing Rules 2020 & 2025. The selection of literature was driven by relevance to key themes identified in the study, including affordability, spatial accessibility, community participation, and housing finance.

The sources were systematically screened based on their relevance with the research problem, pragmatic or case-based evidence, and recency and credibility of citation. Studies deficient in methodological clarity, contextual alignment, or direct relevance to affordable housing were excluded. This filtering ensured that only relevant and meaningful literature derive the conceptual framework of the research.

3.1.2 QUANTITATIVE (PRIMARY DATA COLLECTION):

The second phase involved primary data collection through semi-structured interviews with 150 participants belonging to low-income and working-class groups. Participants were selected through random sampling technique; particularly including domestic workers, residents of informal settlements and those residing in shared housing arrangements. This ensured diversity in the selected study sample, while maintaining focus on the target demographic group that is the most affected by housing affordability issues.

3.2 STUDY AREA

Considering that the policy formulation acknowledged the research and data explaining socio-economic dynamics of big cities while smaller urban centers remained underrepresented (Latif Abdul, 2020) (Sindhu, 2025). Multan was selected for primary data collection due to its evolving urban character. As an emerging metropolitan center and a functional capital of Southern Punjab. Multan represents a transitional urban condition, bridging characteristics of both large metropolitan cities and smaller towns (Ali & Shafiq, 2022). Thereby, providing a relevant context where the psychology of smaller towns persists alongside rapid urban growth, making it an appropriate case to examine the gap between housing policies and the lived reality of urban poor.

3.3 DATA COLLECTION TECHNIQUES

Primary data was collected using a semi-structured interviews guided by pre-designed questionnaire (Kallio, Pietilä, Johnson, & Kangasniemi, 2016). It was conducted in an interactive manner, allowing respondents to elaborate on their experiences, preferences, and constraints. The questionnaire was structured to capture the key variables identified in the literature and policy review:

- Socio-economic Profile: Employment type, income bracket, and number of dependents.
- Financial Status: Current residence status, active debt levels, and the impact of transportation costs on monthly income.
- Housing Hurdles: Awareness of affordable housing schemes, obstacles in securing plots, and fears regarding installment default.
- Preference To Overcome Hurdles: Food and housing security, pay roll installment mechanism, long-term labor retention with minimal salary, workplace proximate duplexes vs remote plot and communal spaces.

This approach enabled both quantitative responses (for measurable patterns) and qualitative insights (for deeper understanding).

3.4 ANALYSIS

The collected data was analyzed using a combination of descriptive statistical methods, including percentage distributions and bar charts, to identify key trends and patterns (Field, 2018). This was complemented by comparative analysis with existing policy provisions and findings from the literature review to evaluate consistency and gaps. Additionally, interpretive analysis was employed to understand behavioral patterns, user preferences, and underlying socio-economic dynamics (Braun & Clarke, 2006). This triangulation of analytical approaches strengthened the validity of the findings and ensured a coherent alignment between theoretical frameworks and ground realities (Creswell & Clark, 2018)

3.5 LIMITATIONS

The primary limitation of this study is its geographic focus on Multan for primary data collection. The housing preferences and constraints in larger metropolises like Karachi may differ substantially. Furthermore, the study relies on the self-reported income and financial struggles of participants, which may be subject to response bias.

3.6 ETHICAL CONSIDERATIONS

All participants in survey were informed of the research purpose, and their participation was entirely voluntary. To maintain confidentiality, personal identifiers were removed from the data, and results are presented in aggregate forms (e.g., percentages of income brackets and employment types)

4. ANALYSIS

To evaluate the efficacy of current housing approaches against user needs, the analysis synthesizes policy review, spatial assessment of housing schemes, and primary data from low-income communities. The findings are examined in light of key principles identified in the literature, including workplace proximity, financial accessibility, participatory planning, context-sensitive development and public private partnership.

4.1 POLICY REFORMS AND THEIR SOCIO-SPATIAL IMPLICATIONS

The review of recent housing policy reforms in Punjab indicates a clear emphasis on facilitating development processes and enhancing developer flexibility. However, these reforms primarily address supply-side efficiency, with limited consideration for the socio-economic realities of intended beneficiaries. Although policies mandate allocation of a proportion of land for affordable housing but no mechanism ensures alignment with actual income distribution across population groups (i.e. 20% vs 40% population).

Furthermore, the flexibility to fulfill 20% quota through 3-5 Marla plots or apartments often results in developer preference for relatively higher-value options, limiting true affordability for the urban poor. Moreover, the planning standards (30 feet right-of-way) discourage development of smaller, genuinely affordable units. Consequently, housing schemes tend to cater to lower-middle income groups rather than the most economically vulnerable segments (Tirmizi, 2006).

The policy intervention allowing development of Land Sub-Divisions as Housing Schemes has contributed to fragmented urban development. The emergence of dispersed developments lacking integrated infrastructure and services increases dependency on external urban centers, thereby raising transportation costs and reinforcing spatial inequities. This pattern directly contradicts the literature's emphasis on location efficiency and integrated planning.

4.2 AFFORDABLE HOUSING FRAMEWORKS IN PRACTICES

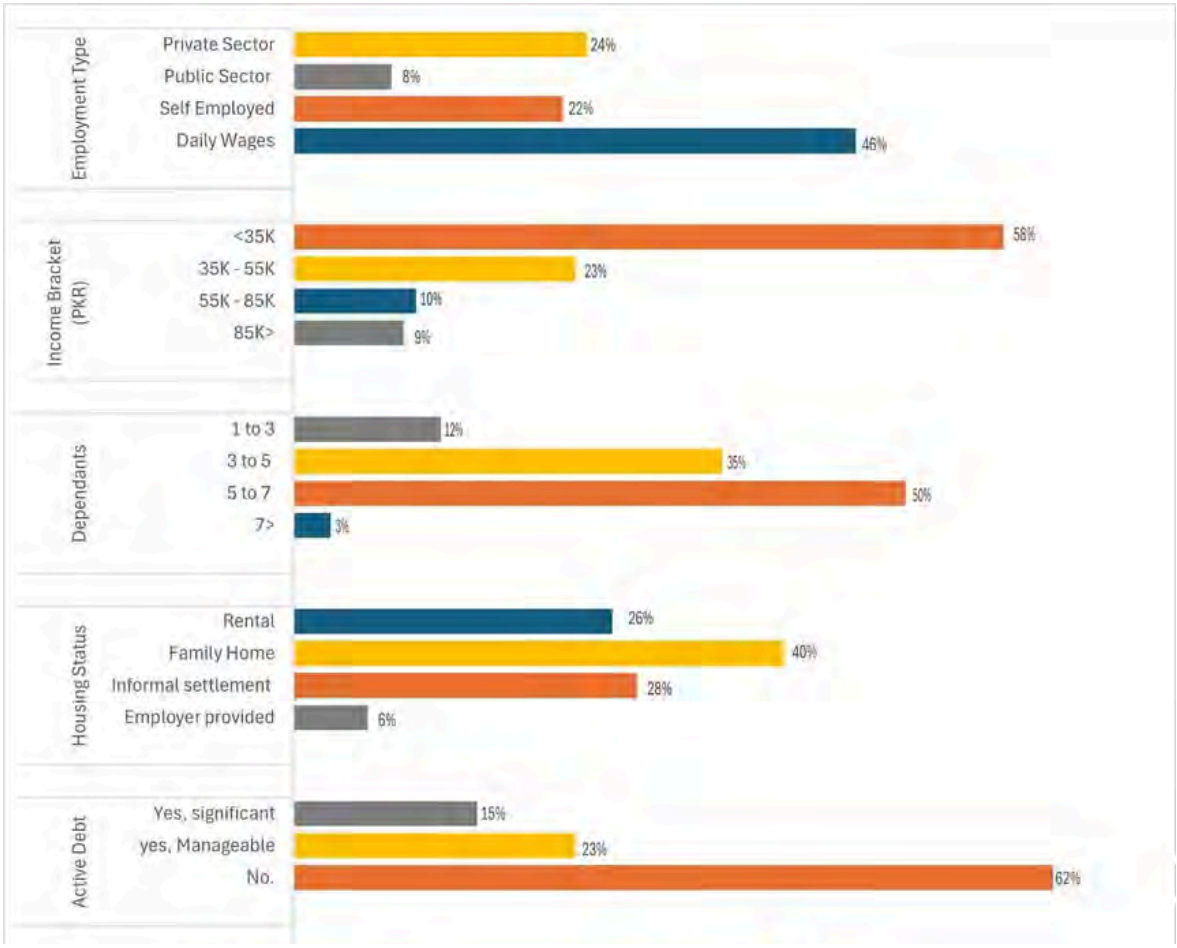
The introduction of affordable housing regulations reflects an institutional acknowledgment to address housing deficit. A decent number of Housing Schemes were launched under these rules with enforced execution of less than 3 Marla plots. However, the analysis suggests that these frameworks remain limited in their ability to deliver meaningful affordability.

The presence of price regulation for affordable housing units along with restrictions on larger plot sizes (i.e. 1 Kanal), limited the feasibility of cross-subsidy models. Thereby reducing developers' ability to balance financial feasibility with affordability objectives. Additionally, incentives offered for increased allocation of affordable housing are practically insufficient when compared to the cost of land and development. Moreover, in the revision of Affordable Housing Scheme Rules in 2025 the additional incentives offered, were limited to "Special Initiatives" alone.

A spatial analysis of implemented housing schemes further reveals a consistent trend of affordable housing developments being located in peripheral areas, often 16 to 60 kilometers from major urban centers. This locational pattern reflects developers' reliance on low-cost land to maintain project feasibility. However, the increased transportation costs, extended commute times, and limited access to essential services offset the initial cost advantages of these schemes while compromising over the intended purpose of affordability (Fan, Chen, & Yang, 2025).

4.3 PREFERENCES OF LOW-INCOME COMMUNITIES

To bridge the gap between housing policies and user needs, primary data collected from working-class households and informal settlement residents was critically analyzed. The findings indicate that housing affordability is deeply intertwined with livelihood and mobility considerations. The data (the bar chart in Figure:1) illustrates that 51% of respondents were spending over 30% of their income on transportation, particularly those residing in peripheral or shared housing arrangements. This reinforces the importance of **workplace proximity**, as highlighted in the literature.



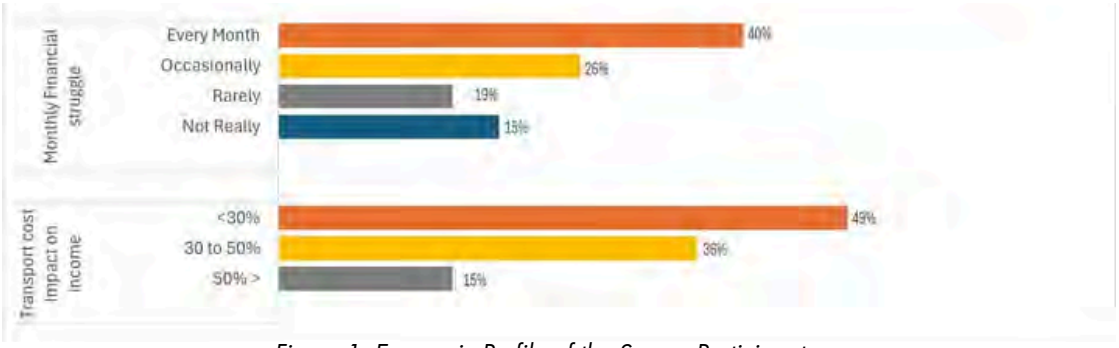


Figure 1: Economic Profile of the Survey Participants.

Almost 66% of the households reported difficulty in managing monthly expenses even without existing debt (see in Figure:1). Reinforcing that financial barriers remain a dominant constraint in securing a house. The key financial challenges attributed (in the bar chart of Figure:2) were; Inability to sustain monthly installment (43%) and High upfront payments (21%) (Malik, 2023). The challenge of monthly installment was majorly backed by the fear of installment default and instable income (66% and 62% respectively).



Notably, awareness of government housing schemes and financing options was found to be extremely limited, indicating a gap not only in policy design but also in outreach and accessibility (see bar chart in Figure:2). Depite these constraints, respondents demonstrated clear preferences for alternative housing models. A housing model that is directly linked with employment opportunities was favored by 41% respondents while 46% supported subject to proximity between the two (see bar chart in Figure:3).

This reflects that job security along with proximity concerns are primary determinant of affordability as they play critical role in shaping housing choices. As workplace proximity in housing significantly reduces transportation costs and daily commute problems. This emphasizes the importance of integrating housing into economic centers rather than locating developments in peripheral areas.

There was considerable support for long-term financial arrangements, with the assurance to be provided financial assistance to accommodate basic necessities. The (bar chart in Figure:3 reflects) tenure-based installment mechanism was favored by 77% participants, in comparison with the conventional loan structures, which often impose rigid repayment conditions. This method was regarded as an escape, to reduce the perceived risk of default.

In terms of spatial design, 81% respondents favored adaptable housing typologies (see Figure:3). Supporting shared and communal spatial arrangements for open spaces and parking. Indicating a preference for cost-efficient and socially cohesive living environments that align with existing community practices. These preferences closely align with participatory planning and contextual design discussed in the literature, as well as with the community-driven housing initiatives of Anguri bagh Housing (Lahore) and Khuda ki Basti (Hyderabad).

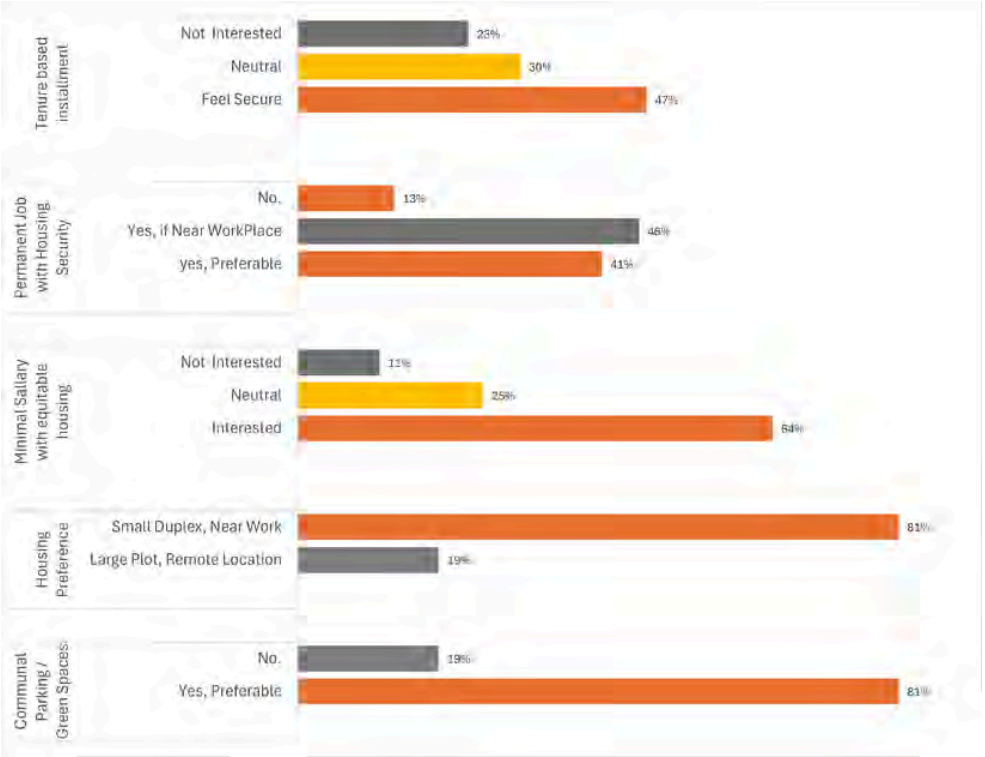


Figure 3: Solutions to Overcome Hurdles, Faced by the Urban Poor's in Securing a House.

5 FINDINGS AND DISCUSSION

The analysis reveals the structural disconnect between the policy provisions and lived reality of the low-income population. The formally designated affordable housing units are often acquired by speculative investors due to developer-oriented policy reforms rather than being user-centered. Evidence from policy review and primary data collected through survey suggests that the core issue is not merely the provision of affordable housing, but the absence of equitable housing systems (Fan, Chen, & Yang, 2025).

Evidence from both policy analysis and primary data demonstrates a clear misalignment of policy with user preferences. The absence of income responsive planning in the policy has sustained the demand and supply gap. This is aggravated by the misalignment of the housing supply proportions with the income distribution of population. Resultantly, a basic necessity is transformed into an investment commodity by keeping it out of reach for the lowest-income groups.

A major contributor in this policy flaw is issue related to the planning standards and infrastructure provisions. The requirement of wide road networks contributes in increasing land consumption and development costs, without considering functional benefits for low-income users (Rehman & Naeem, 2017). Survey findings indicate that mobility patterns in low-income group are largely non-motorized or low-cost (Tirmizi, 2006). Henceforth, adopting more context-sensitive infrastructure standards, aligned with actual user needs could reduce costs and improve overall efficiency.

Additionally, the study identifies issues related to spatial implications of policy reforms, particularly the revision of the "Land Lock Policy". The relaxation in the earlier constraints has enabled, development of isolated housing schemes on small parcels of land that are not integrated with existing infrastructure. Such small fragmented developments lack essential services and compel residents to travel longer distances accommodate employment, education, and healthcare needs.

Consequently, the affordability of such schemes is counteracted by increased transportation costs. This highlights the worth of spatial integration in housing policy. This pattern directly contradicts the principles of location efficiency emphasized in the literature and highlights the need to reintroduce spatial controls that ensure connectivity and integration with existing settlements. User responses further, reinforce the importance of proximity, spatial inclusive and housing models that reflect everyday living needs (Cooper, 2024).

The analysis also reveals limitations within current financial mechanisms in housing development, contributing to raising proximity issues. Although policies introduce certain incentives and regulatory

provisions to ease development but they do not adequately address the matter of financial feasibility for a developer. The restriction regarding maximum plot size, limits the cross-subsidy options and hence offsets the ability of developer to deliver genuinely affordably housing units. On the other the financial models offered to the low-income group demands for high upfront costs and rigid installment structures restrict accessibility (Mielke & Cermeno, 2021) . The study suggests a need for more flexible policy instruments that offer financial flexibility to both the developer and user, while ensuring inclusive planning for all.

Closely linked to this idea is a strong relationship between housing and employment security, highlighted in the study. A clear preference for integrating livelihood opportunities in housing models was supported by the survey participants. In this regard inclusive planning is instrumental in aligning housing provisions with employment security. findings suggest adoption of flexible financial models that offer longer repayment periods with reduced entry barriers and installments aligned with income flows. This would reduce the risk of default and enhance long-term sustainability as well.

In terms of architectural solutions, the findings challenge the generalized promotion of high-rise housing models. While they effectively address the housing challenges in large metropolitan areas, their acceptance in emerging cities like Multan is limited due to socio-cultural preferences and practical constraints related to maintenance and accessibility. The study identifies low-rise, high-density alternatives as a more contextually appropriate solution to optimize land use and reduce construction costs through shared infrastructure.

Moreover, to ensure contextually relevant design, both literature and empirical findings emphasize the importance of community participation. As uniform regulatory standards fail to account for regional variations in socio-economic conditions and urban dynamics (Malik, 2023). The projects that historically incorporated future inhabitants' involvement in planning and execution, demonstrated increased user satisfaction and improved long-term sustainability. Therefore, this study necessitates the integration of inhabitant's perspective in design to achieve localized and user-sensitive design approach.

Finally, the study reinforces that public private partnership; is an internationally acceptable model in housing sector as it is benefits the Government as well as the developer. It eliminates financial burden from the government while expanding development opportunities and revenue potential for the developer (Hyde, 2022), provided that they are guided by regulatory frameworks that prioritize social equity alongside economic returns.

Overall, these findings and interpretations suggest the need to shift from conventional models of affordability toward a unified policy framework that integrates site selection, mobility considerations, and adaptable financial mechanisms to achieve genuinely inclusive housing outcomes.

6. POLICY RECOMMNDATIONS/PROPOSED FRAMEWORK

Based on the findings and discussion, the study proposes the following recommendations and framework components to be incorporated in housing policies:

6.1 LAND-COST CROSS-SUBSIDIZATION MODEL

The proposed framework advocates income-based financial distribution in housing schemes, ensuring proportional allocation for high-, middle-, and low-income groups aligned with population needs. It promotes an integrated cross-subsidy mechanism where revenues from commercial and luxury units are utilized to offset the cost of affordable housing, reducing dependence on public funding (Malik & Nurunnabi, 2024).

Existing studies support mandatory inclusion of 3-marla plots as a minimum affordable housing unit (Rehman & Naeem, 2017), typically recommended at 10–15% of total development (Ahsan, 2019) (The Urban Unit, 2025). This approach enhances financial viability for developers while ensuring inclusive urban growth and long-term affordability for low-income households through reduced housing and rental burden.

6.2 EQUIDISTANT WIDESPREAD POCKETS

Equidistant Widespread Pockets is a planning concept. It refers to the creation of small functional spaces ("pockets") that are evenly distributed across an urban area. It ensures equitable spatial access by placing affordable housing within comfortable walking distances, supporting inclusive instead of marginalized urban growth. This aligns with

Inclusive Planning principles advocated by (UN Office of the High Commissioner for Human Rights (OHCHR), UN-Habitat, 2009)

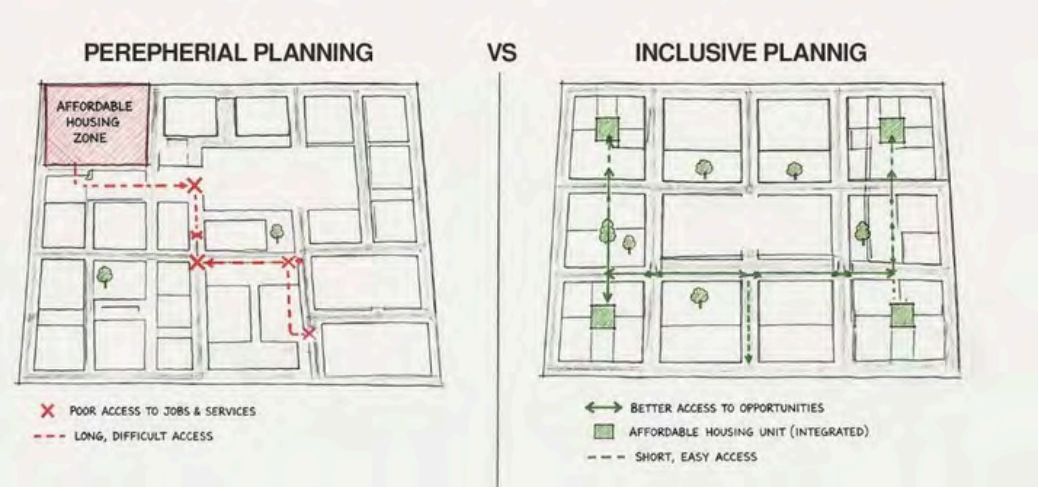


Figure 4: Visual Representation of Equidistant Widespread Pockets with Marginalized Planning Approach.

6.3 SERVICE-LINKED TENURE FOR HOUSING INSTALLMENTS

This model extends the concept of Employers Assisted Housing (Party, 2017) and official government residences by linking housing ownership and repayment to employment tenure. In this model the employer provides housing with the deduction of monthly installment in place of house rent allowance. It suggests transfer of ownership upon completion of the agreed payment/service period.

In case of termination of contract from either party, the dues would be settled immediately. while provisions may be made for continued employment support where possible. While in case of unforeseen reasons (like death) provisions may be made for continued employment support where possible. The approach can be adopted by government bodies or developers on the model of service providing agencies.

With this model the service roles (security guards, sweepers, Cook, baby sitter, office boy, driver etc.) in any developed schemes can be made filled by more reliable, loyal and efficient employees. By integrating housing with employment, the model enhances financial security for workers while improving workforce reliability thereby ensuring mutual benefit across different income groups.

Furthermore, Involving the employees (future inhabitants) in construction process can also reduce the initial cost while maintaining quality (Party, 2017). It shifts the trend from welfare-based provision to reciprocal inclusion, replacing the idea of "serve the poor" (Malik & Nurunnabi, 2024) with "serve and be served".

6.5 REVISITING LAND LOCK POLICY IN HOUSING SCHEMES

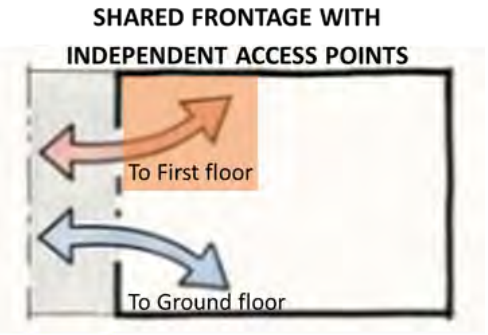
This study recommends reviving and strengthening land lock provisions within private housing scheme regulations with enhanced execution. This would control unplanned urban expansion that contributes for increased traffic congestion and energy consumption in mobility. By reinforcing controlled and contiguous development patterns, this revision of Land Lock Policy can ensure; more efficient land use, improved infrastructure planning, and reduced environmental and mobility load in urban areas.

6.6 OPTIMIZING LAND USE

This proposal recommends revising the right-of-way standards for low-income schemes from 30 feet to 12-15 feet. This proposal is consistent with traditional settlement patterns while still accommodating emergency access. he reduced land allocation can significantly lower development costs and redirect savings toward housing unit construction.

6.6 DUPLEX INTEGRATION MODEL

It is a housing strategy in which two residential units are combined within a single building footprint, to optimize land use, reduce costs, and increase density while maintaining individual ownership. The Duplex Integration Model proposed in this study is not purely conceptual but has been partially validated through its implementation in the Multan Development Authority (MDA). It was adopted as an alternative to distant apartment-based housing provided for officers. This shift reflects user preference for low-rise, proximity-based models over distant apartments.



This practical application provides preliminary evidence of the model's feasibility in emerging urban contexts. Particularly where socio-cultural preferences favor low-rise, independent living arrangements over high-rise typologies. However, further systematic evaluation is required to assess its scalability, cost efficiency, and applicability across different income groups. Collectively, these proposals establish a comprehensive framework for thinking beyond affordability in housing. While building a unified policy that aligns financial viability with inclusive, and spatially responsive urban development.

CONCLUSION:

This study critically re-examines the concept of affordable housing in Pakistan and demonstrates that affordability, when treated solely as a financial metric, fails to address the broader realities of socio-spatial inequality. Drawing on policy analysis and empirical evidence from low-income households in Multan, the findings reveal a persistent misalignment between housing policies and the lived experiences of intended beneficiaries. In particular, the data highlights how peripheral housing locations, rigid financing mechanisms, and standardized planning norms collectively undermine true affordability by increasing transportation costs, limiting accessibility, and excluding the most vulnerable populations.

The research contributes to the existing body of knowledge by advancing the notion of "beyond affordability", reframing housing as an integrated system that links spatial planning, livelihood proximity, and financial accessibility. Unlike conventional approaches that focus primarily on supply-side interventions, this study emphasizes the need for income-responsive and location-sensitive unified housing frameworks for all future developments. The proposed model includes land-cost cross-subsidization, equidistant spatial integration, service-linked tenure, and duplex-based density optimization. They offer a more holistic and contextually grounded alternative to prevailing policy practices.

From a policy perspective, the findings underscore the necessity of shifting from developer-oriented regulatory frameworks toward user-centered, equity-driven housing strategies. This includes aligning housing supply with actual income distribution, revisiting infrastructure standards to reflect real mobility patterns, and integrating housing development with employment opportunities. Moreover, strengthening spatial control by revisiting land-lock policies can help prevent fragmented urban growth and promote more efficient, connected, and sustainable settlements. Public–Private Partnerships remain a viable mechanism, but their effectiveness depends on regulatory structures that balance financial feasibility with social inclusion.

While the study provides valuable insights, the proposed models are largely conceptual and partially empirically grounded. Future research should focus on testing these frameworks through financial simulations, pilot implementations, and comparative studies across multiple cities to evaluate their scalability and long-term viability. Additionally, incorporating more advanced quantitative techniques could further strengthen the empirical basis of such policy innovations.

In conclusion, achieving equitable housing requires a fundamental paradigm shift from viewing housing as a commodity toward understanding it as a multidimensional socio-economic system. By integrating policy, planning, and finance with the everyday realities of low-income communities, the study offers a pathway toward more inclusive, sustainable, and socially responsive urban development.

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PAPER 2:

Beyond Affordability: Informal Densification and the Crisis of Housing Adequacy in Danishabad, Peshawar

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ABSTRACT

Housing policy across the Global South has long been evaluated through a single metric: whether peoplecanaf ord to pay the rent. This study argues that af ordability, on its own, tells us nothing about whether the structurebeing rented is safe to inhabit. Drawing on the World Urban Forum 2026 theme - Housing the World: SafeandResilient Cities - this paper examines nine years of unregulated densification in Danishabad, a planned residential neighbourhood in Peshawar, Khyber Pakhtunkhwa. The research documents what that densification has produced: buildings that are cheap to rent and genuinely dangerous to live in. The study assesses Danishabad's rental housing stock against the seven criteria of Adequate Housing as definedbyUN-Habitat and the OHCHR framework, and measures the consequences of systematic failure against thosecriteria. The methodology combines longitudinal field observation spanning 1999 to 2025, collaborative structural inspections of fifty buildings conducted with practising civil engineers and architects, and eighteen semi-structuredinterviews with long-term residents and student tenants. The findings establish that the overwhelming majority of the neighbourhood's rental stock fails on habitability, structural safety, and regulatory compliance simultaneously. This paper introduces the Equitable Living Index (ELI)- a four-pillar, field-deployable measurement tool calibrated to WHO Housing and Health Guidelines (2018) andUN-Habitat adequacy criteria - and applies it to the audit sample. Eighty-two percent of inspected structures fall inthe Critically Non-Compliant range. The paper proposes a phased regulatory roadmap for Capital MetropolitanGovernment West, aligned with SDG 11.1, and of ers a model replicable in other university-adjacent informal rental zones across the region.

KEYWORDS:

Adequate Housing; Informal Densification; Studentification; Seismic Vulnerability; SDG11.1; Equitable Living Index; Khyber Pakhtunkhwa

1.INTRODUCTION:

Housing is lived, not simply purchased. The family crowding into a subdivided villa near the University of Peshawar does not experience their accommodation as a rent-to-income calculation. They experience it as the space they breathe in through a night with no working window; as the wall they press a hand against and feel the dampness coming through; as the floor that carries their weight in a city sitting at the convergence of some of the most seismically active geology in South Asia. The prevailing logic of housing policy in Pakistan - and across much of the Global South - has reduced this complexity to a single arithmetic question: is it affordable? What has gone largely unasked is the companion question that every long-term resident of Danishabad can answer from direct experience: is it safe?

Danishabad is a planned residential neighbourhood under the jurisdiction of Capital Metropolitan Government West, situated in the eastern urban fabric of Peshawar. Its location within walking distance of the University of

The paper proceeds as follows: Section 2 situates the research within existing scholarship on housing adequacy, studentification, and seismic risk. Section 3 describes the methodology. Sections 4 and 5 present case study findings
and aggregated audit results. Section 6 introduces and applies the Equitable Living Index. Section 7 offers discussion, and Section 8 sets out strategic recommendations and an implementation roadmap. Section 9 provides conclusions.

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 The Limits of the Affordability Lens

The right to adequate housing was first articulated through Article 25 of the Universal Declaration of Human Rights in 1948 and substantially elaborated through OHCHR's General Comment No. 4 (1991), which established seven
simultaneous criteria: security of tenure; availability of services, materials, facilities, and infrastructure; affordability; habitability; accessibility; location; and cultural adequacy (OHCHR, 1991; UN-Habitat, 2023). The normative weight of this framework lies in its simultaneity. All seven criteria must be satisfied for housing to be considered adequate. Satisfying one in isolation - affordability, for instance - is not compliance. It is partial delivery
of a right.

This distinction has direct practical consequence. UN-Habitat estimates that nearly 1.1 billion people globally live in slums or slum-like conditions, with cities physically expanding at 5.6 percent annually while planned densification proceeds at only 1.5 percent (UN-DESA, 2024). UN-Habitat explicitly cautions that rapid housing production without strategic frameworks generates poor spatial planning and deepened inequality (UN-Habitat OEWG-H, 2024) — a warning that describes Danishabad's present condition precisely.

2.2 Studentification and Informal Rental Densification

The concept of studentification - coined by Darren Smith (2005) to describe socio-spatial neighbourhood transformation driven by concentrated student influx - has since been documented in Global South contexts where it is driven by informal economic opportunism rather than institutional investment. Studies from South Africa confirm that studentification produces physical degradation and density increases that planning frameworks are structurally ill-equipped to manage (Scheba et al., 2025). Research on informal rental housing across the Global South identifies that while such rentals serve genuine economic needs, their unplanned proliferation generates severe neighbourhood-level harm that falls disproportionately on the most economically precarious tenants (Scheba et al.,
2025).

Ananya Roy's theory of state-produced informality provides the sharpest conceptual anchor here: informal housing is not simply absent regulation, but a selective non-application of existing rules that functions as tacit authorization for speculative densification (Roy, 2011). The governance conditions documented in Danishabad map precisely onto this framework.

2.3 Health Consequences and Seismic Risk

WHO Housing and Health Guidelines (2018) establish that overcrowding and inadequate ventilation significantly elevate respiratory infection risk and chronic health compromise. Peshawar's location at the convergence of the Indian and Eurasian tectonic plates, within Seismic Zone 2B, compounds these risks: the 2005 Kashmir earthquake - 87,000 deaths, attributed primarily to unauthorized masonry construction - demonstrates the lethal consequence of exactly the structural typology documented in this study (NHESS, 2020; Springer, 2025).

2.4 Identified Gaps and Theoretical Positioning

The existing literature establishes that informal rental densification driven by student demand produces predictable

physical, health, and governance consequences - well-documented in specific national contexts but rarely subjected to longitudinal measurement within a single neighbourhood using an integrated multi-dimensional adequacy framework. This paper fills that gap. It draws on Roy's (2011) theory of state-produced informality to interpret the governance findings; on WHO (2018) and the European Respiratory Society (2023) to ground the health analysis; and on the UN-Habitat seven-criterion framework (OHCHR, 1991; UN-Habitat, 2023) as its normative measurement baseline. The Equitable Living Index introduced in Section 6 operationalises that framework into a deployable field instrument.

3. METHODOLOGY

3.1 Longitudinal Site Observation (1999–2025)

This research uses a qualitative, practice-based architectural methodology integrating longitudinal site observation spanning 1999 to 2025, collaborative field inspection, and direct resident testimony. The 26-year baseline originates in the researcher's resident and professional engagement with Danishabad from 1999 - a period during which the neighbourhood functioned as a broadly compliant, low-density residential zone. Spatial transformation was tracked through periodic site visits; formal metric measurement was conducted in 2024–2025 against the KP Building Regulations 2021 (Amended). The active densification phase - the period during which unauthorized hostel construction accelerated - is dated from approximately 2016, giving the transformation documented in this study a nine-year intensification window within the broader twenty-six-year observational baseline.

3.2 Field Inspection and Collaborative Technical Assessment

Fifty buildings were selected through purposive sampling, prioritizing structures with unauthorized height extensions, high-occupancy use, or visible structural distress. Approximately thirteen had undergone residential-to hostel conversion; the remainder were newly constructed buildings erected in violation of zoning bylaws. Field inspection was conducted collaboratively with civil engineers and architects who prepared signed inspection reports against BCP Seismic Provisions 2007. No approved building plans were available from Capital Metropolitan Government West for any hostel structure — all operate in violation of residential zoning, with the authority holding only falsely declared residential plans.

3.3 Resident Interviews

Eighteen semi-structured interviews were conducted - nine with long-term residents who had lived in Danishabad for a minimum of fifteen years, establishing a pre-densification baseline, and nine with current student tenants. All data is anonymised and held by the researcher.

3.4 Limitations and Ethical Considerations

This research is bounded by its geographic specificity. While the findings are analytically transferable to other university-adjacent informal rental zones in KP and comparable South Asian contexts, direct quantitative generalization is not claimed. The absence of official building records from Capital Metropolitan Government West - itself a significant finding - limits the possibility of pre-densification quantitative comparison using official data sources. All participants provided verbal consent and data is anonymised. Access to female hostel environments was restricted; Figure 8 is an architectural drawing reconstructed from the original approved plan and field measurements taken during inspection — not from memory.

4. CASE STUDY: DANISHABAD - TWENTY-SIX YEARS OF OBSERVATION, NINE YEARS OF UNRECORDED TRANSFORMATION

4.1 Neighbourhood Context

Danishabad is a planned residential neighbourhood under the jurisdiction of Capital Metropolitan Government West, positioned in the eastern urban fabric of Peshawar. Its location within walking distance of the University of

Peshawar - established in 1950, enrolling approximately 14,000 students, and the only general-category public affiliating university for all of Khyber Pakhtunkhwa (University of Peshawar, 2025) - as well as Gandhara University, Khyber Medical College, and a concentrated belt of more than twenty competitive examination academies, has produced a demand profile with no parallel in any other Peshawar neighbourhood of comparable physical size. Danishabad is, in that sense, a uniquely pressured environment.

In 1999, Danishabad operated broadly as its planning designation intended: single- and two-storey houses with compliant setbacks, natural light, and working ventilation. That baseline no longer exists. Long-term residents interviewed for this study described the transformation in direct terms. One resident who has lived on the same street since 1987 put it plainly:

"پہلے یہاں خاندان رہتے تھے، گھروں میں آنگن ہوتے تھے اور ہوا آتی تھی۔ اب اگر چائے پینے بیٹھیں تو سامنے والی چھت نظر آتی ہے - سورج نہیں۔"

("Families used to live here - houses had courtyards, there was airflow. Now if you sit for tea, you see the next rooftop. No sky, no sun.")

Long-term resident, Danishabad (anonymised). Resident since 1987.

The figures 1 and 2 below document current conditions, and Table 1 quantifies the transformation across key spatial metrics.

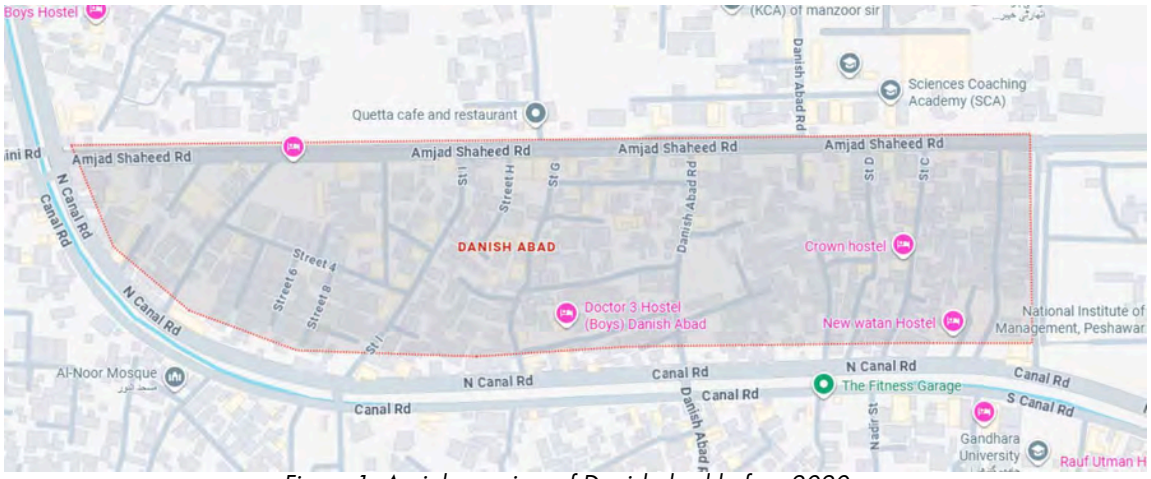


Figure 1: Aerial overview of Danishabad before 2020.

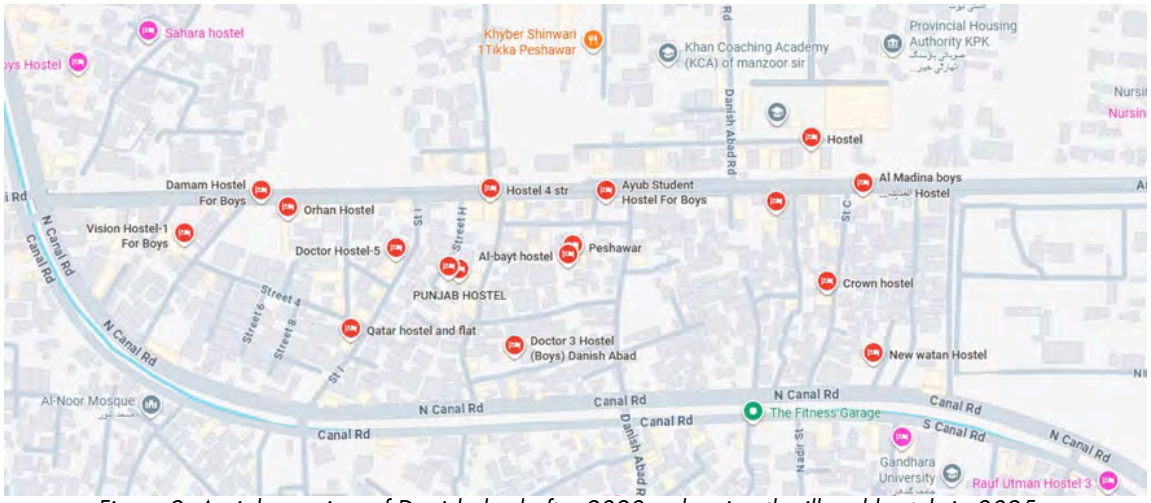


Figure 2: Aerial overview of Danishabad after 2020. - showing the illegal hostels in 2025.

4.2 Spatial Transformation: Key Metrics (1999–2025)

Table 1 compares field-measured spatial averages across the fifty-building sample against 1999 baseline observations and the requirements of the KP Building Regulations 2021. The picture it presents is not one of partial

or selective non-compliance. It is one of systematic, comprehensive abandonment of applicable standards across every measurable dimension of the built environment.

Table 1: Spatial Transformation of Danishabad — Densification Phase (2016–2025) within Observational Baseline (1999–2025) vs. KP Building Regulation Standards

Spatial Metric	1999 Baseline	2025 Observed	KP Regulation 2021
Plot Coverage Ratio	~45%	Up to 95%	65% Maximum
Minimum Room Size per Occupant	~15 m²	7 m² or less	10 m² Minimum
Mandatory Open Space	~30%	Less than 2%	20% Minimum
Building Height (Storeys)	G + 1	G + 4 observed	G + 1 (residential zone)
Side/Front Setback Compliance	Nil in 64% of structures	Nil in 87% of structures	Min. 5 ft side / 10 ft front
Natural Ventilation	Cross-ventilation standard	Zero airflow in majority of rooms	Min. 15% window-to-floor ratio

Source: Author's field observations and collaborative professional inspections (2025); KP Building Regulations 2021 (Amended); Capital Metropolitan Government West zoning standards.

5. ANALYSIS AND FINDINGS: THREE DIMENSIONS OF FAILURE

5.1 Policy and Governance Failure

The governance dimension of Danishabad's crisis is the least visible and the most consequential. Capital Metropolitan Government West holds, in its records, only falsely declared residential floor plans for buildings that are actively operating as commercial hostels. Not a single approved hostel floor plan exists for any structure in the audit area because these hostels are, in zoning terms, illegal - operating in a designated residential zone without usechange approvals or the hostel NOCs that commercial operation requires. This is not a bureaucratic oversight. It is a structural condition: the regulatory authority's formal record bears essentially no relationship to what has been built, what those buildings are used for, or how many people live inside them.

Despite formal community petitions submitted to Capital Metropolitan Government West - documented in resident testimony gathered for this study - no enforcement action has been recorded against any of the fifty audited structures. Roy's (2011) framework of state-produced informality fits what is happening here better than any other available explanation. The regulations exist. They are simply not applied - and that non-application benefits the landlords and developers with enough political weight to make sure it stays that way, while the authority keeps its hands formally clean.

The 2023 Census data offers one measure of the human cost. The University of Peshawar Town Council area records a negative population growth rate of -5.39 percent annually between 2017 and 2023 (PBS, 2023). That figure does not indicate the area is emptying. It indicates that original registered residents - long-term families - are leaving, replaced by a transient student population that census methodology cannot adequately capture. One longterm resident summed up this displacement process directly:

"یہ جگہ اب رہنے کے قابل نہیں رہی۔ ہم بھی یہاں سے جانا چاہتے ہیں، لیکن ہمارے پاس اتنے پیسے نہیں، اس لیے مجبوری میں یہاں رہتے ہیں۔ یہاں شور، رش، ٹریفک اور غیر محفوظ ماحول ہے۔ پہلے کوئی اجنبی آتا تو سب پوچھتے تھے، اب محلے میں بہت زیادہ اجنبی آتے ہیں۔"

("This place is no longer fit for living. We also want to leave, but we do not have enough money, so we live here out of compulsion. There is noise, rush, traffic, and it no longer feels safe. Earlier, if a stranger came here, everyone noticed, but now many unfamiliar people come into the neighborhood.")
Long-term resident, Danishabad (anonymised). Resident since 1995.

5.2 Structural Failure: Case Study 01 - Street C

A property on Street C, originally approved as a single-family residential unit at Ground + 1, has been extended vertically to Ground + 3 without any approval from Capital Metropolitan Government West. Figure 3 documents the full elevation of the current structure.



Figure 3: Unauthorized Ground + 3 vertical extension on originally approved residential structure, Street C, Danishabad. (Source: Author field survey, 2025)

Field inspection conducted collaboratively with structural engineers found that the building relies on undersized 9-inch brick masonry columns to carry the dead load and live loads of multiple reinforced concrete slabs across four storeys - a structural arrangement that does not meet the requirements of the Building Code of Pakistan Seismic Provisions 2007 for multi-storey construction in Seismic Zone 2B (BCP, 2007). Figure 4 documents this column arrangement.



Figure 4: Undersized 9-inch masonry column supporting upper-floor slabs in Ground + 4 structure. (Source: Author field survey, 2025)

Diagonal cracking visible in masonry walls (Figure 5) is a standard engineering indicator of stress concentration and structural overloading - a pattern that engineers participating in the inspection identified as consistent with lateral load distribution inadequacy in an un-reinforced vertical extension.



Figure 5: Diagonal cracking in masonry wall indicating structural stress and overloading. (Source: Author field survey, 2025)

Internal partition and load-bearing wall thicknesses measured at approximately 4.5 inches (Figure 6) fall below minimum requirements for multi-storey structural loads. Moisture seepage and damp wall deterioration (Figure 7) indicate water ingress and inadequate waterproofing - conditions that accelerate material degradation and compound the structural risk profile over time.



Figure 6: 4.5-inch wall thickness measured in upper-floor partition - below minimum requirements for multi-storey load conditions. (Source: Author field survey, 2025)

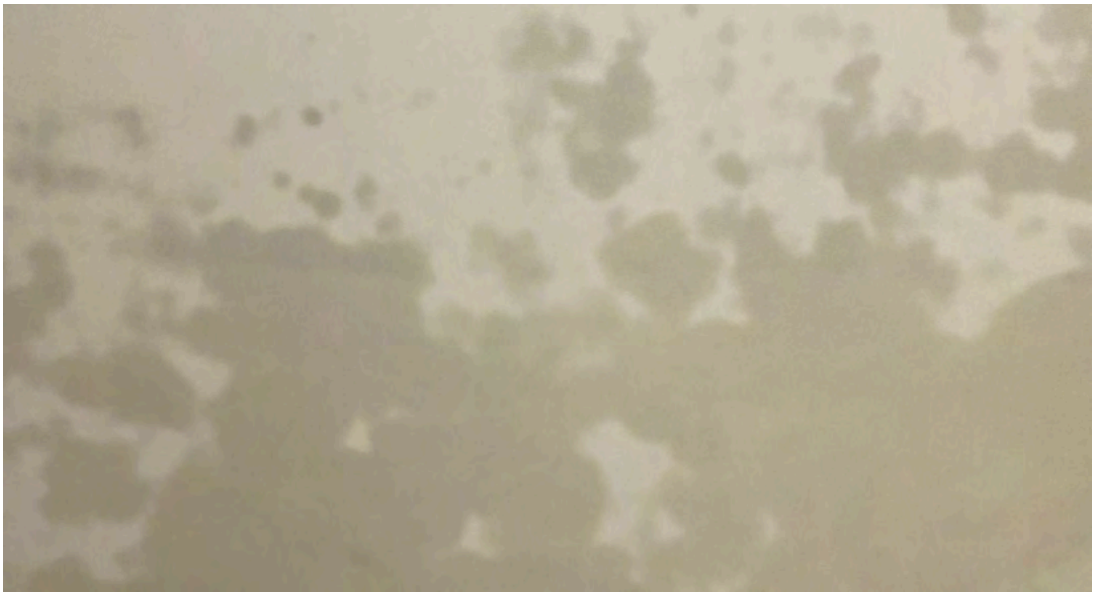


Figure 7: Wall seepage and dampness due to inadequate waterproofing, documenting accelerated material degradation. (Source: Author field survey, 2025)

The structural risk profile of this building must be read against Peshawar's seismic context. Probabilistic hazard mapping for the district places bedrock peak ground acceleration at 0.16 to 0.40g for 475-year return periods (NHESS, 2020). The 2005 Kashmir earthquake - 87,000 deaths, 780,000 buildings destroyed - was attributed primarily to unauthorized masonry construction of exactly this typology: multi-storey load-bearing walls without lateral resistance systems (Springer, 2025). In structural engineering terms, the building on Street C is a predictable seismic failure waiting for a trigger.

5.3 Environmental and Health Failure: Case Study 02 - Street E

A two-bedroom residential house on Street E - a 5 Marla plot - has been converted into a six-unit commercial hostel without any regulatory approval. The structure was originally a compact single-family home with two bedrooms, a living room, a kitchen, and a covered front porch. Every habitable space in the building has been subdivided or repurposed. Figure 8 presents two architectural drawings produced from the original approved plan and from measurements taken during inspection: the left drawing shows the original layout; the right drawing shows the post conversion hostel configuration.

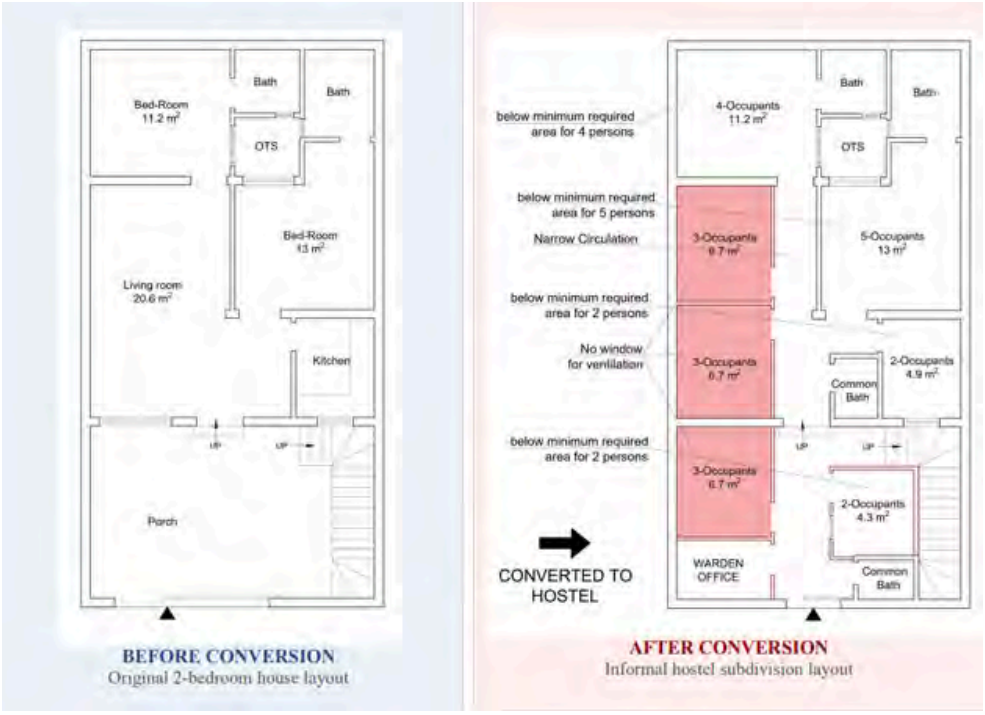


Figure 8: Architectural drawings of a 5 marla residential house on Street E, Danishabad. Left: original approved 2-bedroomlayout before conversion. Right: post-conversion hostel plan derived from field measurements and original drawings, showingsubdivision into 6 units accommodating approximately 13 occupants. (Source: Author's measured drawings, 2025)

The subdivision is comprehensive. The original living room has been split by wooden partitions into two sleepingrooms, each with zero windows and no path to natural ventilation. These two rooms collectively housesixoccupants. The covered front porch has been enclosed and divided into three units: a warden's office, a roomfor three occupants, and a room for two - with windows but poorly ventilation. The kitchen has been convertedintoasleeping room for two occupants, retaining only a side-wall opening under stairs for minimal ventilation. Across theentire structure, four of the six habitable units have zero window access and receive no natural light or airflowwhatsoever. The measured window-to-floor ratio across the zero-ventilation rooms is zero percent - against a minimumof 15percent required under both KP Building Regulations 2021 and WHO housing guidelines. The two living-room- derived rooms measure approximately 6.7 square meters each and accommodate two occupants simultaneously, producing a spatial allocation of 3.4 square meters per person - less than 40 percent of the WHOminimumof 9square meters per occupant. The porch room accommodating three occupants provides approximately 2.3squaremeters per person. The health implications are not speculative. Resident interviews recorded consistent respiratory complaints among student occupants. one student tenant described the conditions directly.

"ہم تین لوگ ایک چھوٹے سے کمرے میں رہتے ہیں جہاں کوئی مناسب کھڑکی نہیں، اس لیے ہوا بالکل نہیں آتی۔ ہمیں اکثر کھانسی رہتی ہے اور صبح اٹھتے ہی سر درد ہوتا ہے۔ ہم یہاں اس لیے رہتے ہیں کیونکہ یہ سستا ہے، جبکہ کھڑکیوں اور بڑے کمروں والے ہاسٹلز کا کرایہ بہت زیادہ ہے"

(Three of us live in a small room with no proper window, so there is no ventilation at all. We often have coughs, and when we wake up in the morning, we get headaches. We stay here because it is affordable, while hostels with windows and bigger rooms have very high rent.)

Student tenant, Danishabad (anonymised).

The building operates as a commercial hostel generating significant monthly rental income for its owner, withnoregulatory record, no structural certification, no fire safety provision, and no ventilation compliance. The owner collects rent every month. The students who live inside it collect respiratory problems. No regulatory bodyhasvisited, and no record of the building's actual use exists anywhere in official files.

5.4 AGGREGATED FINDINGS: SYSTEMATIC NON-COMPLIANCE

Across the fifty-building audit, the evidence establishes a pattern that is consistent, structural, and accelerating. Habitability has broken down: rooms averaging 7 m^2 with near-zero natural ventilation, occupied simultaneouslybymultiple students, violate WHO minimum space standards (WHO, 2018) and KP regulatory thresholds. The healthconsequences reported in resident testimony are consistent with WHO evidence for these exact conditions. Structural safety is absent - and the problem extends beyond older converted stock. Newly constructed buildingsexhibit diagonal cracking and moisture seepage within months of completion, indicating that the quality of newconstruction is as deficient as the unauthorized extension of older structures. Buildings are being erected to Ground+ 4 heights (Figure 9) on structural systems designed for Ground + 1, without engineering certification, in SeismicZone 2B. Regulatory governance has effectively withdrawn. Capital Metropolitan Government West holds no valid buildingrecords for the majority of the neighbourhood's active rental stock. Without field-based intervention of the kinddocumented in this paper, there is no administrative mechanism through which the risk can be quantified, let alonemanaged.



Figure 9: Illegal Hostel Conditions in Danishabad (Source: Author field survey, 2025)

6. THE EQUITABLE LIVING INDEX: A MEASUREMENT INSTRUMENT FOR DENSE RENTAL ZONES

6.1 RATIONALE

Existing housing adequacy metrics in Pakistan operate at the macro level - identifying national patterns of inadequacy but unable to drive enforcement at the level of individual structures. What is needed in a neighbourhoodlike Danishabad is a tool that a trained municipal inspector can deploy on-site, with basic measurement equipment and access to permit records, producing a legally meaningful compliance classification against internationallygrounded standards. The Equitable Living Index is that tool. It is calibrated to WHO (2018) health standards and UN-Habitat adequacy criteria (OHCHR, 1991), and is designed to be applied without specialist engineeringequipment.

6.2 THE FOUR-PILLAR FRAMEWORK

TABLE 2: THE EQUITABLE LIVING INDEX (ELI) - FOUR-PILLAR FRAMEWORK

ELI Pillar	Max Points	Standard Reference	Minimum Threshold	Audit Method
I. Spatial Equity	25	WHO (2018); SDG 11.1	Min. 9 m² per occupant; KP Code: 10 m²	Tape measure + occupancy count
II. Environmental Quality	25	WHO IAQ (2010/2021); KP Code	Min. 15% window-to-floor ratio; cross-ventilation in every habitable room	Window ratio; airflow path check
III. Structural Safety	25	BCP Seismic 2007; FEMA P-154 RVS	Structural cert. for all G+2 and above; no diagonal cracking or moisture compromise	RVS inspection; permit review
IV. Governance & Compliance	25	KP Building Regulations 2021; CMG West Zoning	Valid NOC; height compliance; functional fire egress	Document check; egress walkthrough
TOTAL	100	≥75: Compliant | 50–74: Conditional | <50: Critically Non-Compliant		

Source: Author's framework, calibrated to WHO Housing and Health Guidelines (2018); UN-Habitat Adequate Housing (OHCHR, 1991); Building Code of Pakistan Seismic Provisions (2007); KP Building Regulations 2021.

6.3 APPLICATION TO THE DANISHABAD AUDIT SAMPLE

TABLE 3: ELI COMPLIANCE RESULTS - DANISHABAD AUDIT SAMPLE (2025)

ELI Classification	Score Range	Buildings (n=50)	Notes
Critically Non-Compliant	<50	41 (82%)	Includes both hostel conversions and newly constructed non-compliant structures
Conditional Compliance	50–74	7 (14%)	Older structures with partial spatial compliance but governance deficiencies
Compliant	≥75	2 (4%)	Both in genuine residential use; no hostel conversion; limited occupancy
TOTAL	-	50	Not a single commercial rental structure achieves full ELI compliance

Source: Author's field assessment data (2025), processed against ELI framework.

7. DISCUSSION:

What Danishabad reveals is that housing markets under regulatory withdrawal deliver low cost and highrisksimultaneously. WHO evidence is unambiguous about what overcrowded, unventilated rooms produce (WHO, 2018; European Respiratory Society, 2023), and seismic engineering equally unambiguous about what Ground+4masonry structures with 9-inch columns do in Zone 2B (NHESS, 2020; Springer, 2025). What this paper places onrecord is the governance story: how a regulatory authority ends up holding falsely declared residential plans for unlicensed commercial hostels, and why nothing is done about it. Roy's (2011) framework of state-produced informality is the most precise analytical lens available for this situation. The informal rental economy of Danishabad generates substantial income for a landowning class with political capital. Enforcement would require confronting that class directly. That silence is deliberate. Administrative neglect at this scale does not happen by oversight; it reflects a conscious decision not to confront the people who benefit from it. The ELI cannot fix that political reality - no measurement tool can. What it does is take away one of theeasier excuses for doing nothing: the claim that no clear, workable standard exists against which individual buildings could be judged. When such a standard is formally in place and visible to the public, inaction becomesharder to justify.

8. STRATEGIC RECOMMENDATIONS AND IMPLEMENTATION ROADMAP

Capital Metropolitan Government West should formally declare Danishabad a Special Regulation Zone, subject tocoordinated building code enforcement and mandatory ELI compliance auditing. This creates a clear legal basis for action against structures operating outside their approved use, aligned with UN-Habitat's call for long-termstrategicframeworks (UN-Habitat OEWG-H, 2024) and SDG 11.3. All structures above Ground + 1 lacking structural certification should face mandatory assessment, with retrofittingfinanced through a cost-recovery levy on rental income and irremediable structures managed through a provincial resilience fund. A publicly accessible digital ledger of approved plans and NOCs should be established —makingnon-compliance visible and politically indefensible. ELI certification should be a mandatory condition for legal commercial rental operation, paired with expedited processing, reduced property tax, and subsidized improvement financing.

Table 4: Danishabad Regulatory Implementation Roadmap (2026–2029)

Phase	Timeline	Key Actions	Lead Agencies
Phase 1 - Baseline & Declaration	2026	Full ELI audit of all structures; Special Regulation Zone declared; digital building ledger established; moratorium on unauthorized height additions	CMG West; KP Urban Policy Unit
Phase 2 - Certification & Incentives	2027	ELI Certification Programme launched; subsidized structural improvement loans; mandatory landlord registration; university on-campus housing coordination	CMG West; KP Finance Dept.; University of Peshawar
Phase 3 - Enforcement & Replication	2028–2029	Enforcement against Critically Non-Compliant structures; seismic retrofitting programme; SRZ model replicated to other university-adjacent neighbourhood in KP	CMG West; KPBCA; KP Urban Resilience Fund; NDMA

Source: Author's framework. Aligned with SDG 11.1 (2030 target) and New Urban Agenda (Quito, 2016)

9. CONCLUSION

Danishabad is a neighbourhood that the regulatory record says barely exists as a problem. Capital MetropolitanGovernment West holds no hostel approvals for the area, no record of multi-storey vertical extensions, noacknowledgment of diagonal wall cracks, zero-ventilation sleeping cubicles, or the dozens of students occupyingsubdivided houses designed for a single family. The formal record is a fiction. Behind that fiction, nine years of unregulated densification have produced a built environment that is a demonstrable public health hazardandapredictable seismic catastrophe waiting for a trigger. This paper has attempted to put the reality on record. The field inspections conducted with civil engineers andarchitects, the eighteen resident interviews, the two-floor-plan architectural drawings, and the spatial measurementsthat underpin the tables and case studies in this paper represent the kind of practice-based, longitudinal urbandocumentation that is rarely attempted and almost never published from within the affected city itself. The casefor doing so is simple: cities in the Global South cannot wait for external researchers to document their housingcrises. Practitioners who live and work in these cities, and who have watched the transformation unfold over decades, carry both the knowledge and the professional obligation to speak. The core finding is that Danishabad's housing stock fails simultaneously on habitability, structural safety, andregulatory compliance — and that this failure is not accidental. It is produced by unbounded demand, speculative supply, and selective non-enforcement. Affordability and safety are not a trade-off to be managed. They are a joint minimum requirement the regulatory state has chosen not to enforce. The Equitable Living Index, the Special Regulation Zone proposal, and the 2026–2029 roadmap are offeredasastarting point: calibrated to international standards, grounded in local field evidence, and designed for deployment without specialist infrastructure. Both the ELI and the SRZ model are replicable across KP and comparable SouthAsian university-city contexts. If the World Urban Forum 13 theme of safe and resilient cities means anything in a neighbourhood like Danishabad, it means this: that the measure of housing policy is not whether people can afford the rent, but whether the buildingthey are paying to inhabit will still be standing - safe, ventilated, and structurally sound - when the monsoon comes, or when the earth moves.

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PANEL 1

REIMAGINING HOUSING POLICY: INCLUSION, CLIMATE RESILIENCE, AND URBAN GOVERNANCE

Roma Mukhtar[1], Khawaja Sikander Zeeshan[2], Javed Ali Khan[3], Fariha Tariq[4], Annum Shahid[5]

1.Assistant Professor, University of Lahore (Moderator)
2.Director General, PHATA
3.Country Head, UN Habitat, Pakistan
4.Specialist SWM, The Urban Unit

The panel discussion brought together perspectives from government, international development agencies, academia, and urban governance to reflect on the interconnected challenges of affordable housing, climate resilience, environmental governance, inclusivity, and implementation within the Pakistani urban context. Moderated by Roma Mukhtar, the discussion unfolded less as a sequence of isolated expert opinions and more as an evolving conversation where one issue repeatedly folded into another: housing into infrastructure, climate into planning, planning into governance, and governance into questions of social inclusion and everyday life.

Roma Mukhtar began by situating housing within a much larger urban and political framework. Rather than introducing affordable housing simply as a matter of construction or land provision, she framed it as an issue deeply connected to governance systems, infrastructure delivery, environmental vulnerability, institutional coordination, and social equity. Throughout the session, she repeatedly returned to the relationship between policy and implementation, questioning why carefully written policies so often fail to produce meaningful transformations on the ground. Her moderation consistently pushed the panelists to move beyond technical discussions and engage with the realities of urban life, social inequality, and the structural conditions shaping Pakistani cities today.

The first major theme of the discussion focused on fragmentation between institutions responsible for housing, infrastructure, and planning. Asking how affordable housing could be approached more collaboratively, Roma Mukhtar invited reflection on the structural and institutional barriers that continue to prevent integrated urban development. Responding to this, Khawaja Sikander Zeeshan explained that PHATA currently serves as one of the principal government institutions working specifically on affordable housing in Punjab. He described how traditional housing development in Pakistan has historically produced socially segregated urban environments in which affluent communities occupy well-serviced planned societies while low-income populations are either excluded from formal housing systems or pushed toward informal settlements and underdeveloped peripheral areas.

Against this background, he discussed PHATA's recent efforts to move toward a more inclusive housing model. Under the Affordable Private Housing Schemes Rules, private housing developers are now required to allocate 20% of their land toward affordable housing. According to him, the intention behind this policy is not merely to increase the number of low-income housing units, but to rethink the social structure of housing itself by integrating different economic groups within the same developments. He emphasized that low-income housing should not exist separately from middle- and upper-income communities because segregation ultimately reproduces exclusion, inequality, and infrastructural imbalance across cities. Instead, he argued for a model of integrated and inclusive housing where affordability becomes embedded within the broader urban fabric. He explained that several housing schemes across Punjab have already begun implementing this model and that affordable units would soon be delivered through these initiatives.

However, his response quickly moved beyond the issue of housing delivery itself and into a broader critique of governance and planning systems in Pakistan. One of the key problems he identified was the absence of consolidated and digitized planning data. Without accurate and coordinated information about housing societies, infrastructure systems, and urban growth patterns, long-term planning becomes fragmented and reactive. He argued that Pakistan's cities are growing at a pace far beyond the capacities of existing planning systems and master plans. Infrastructure originally designed for limited populations is now expected to serve populations many

times larger, resulting in overloaded sewerage systems, environmental degradation, congestion, and severe. The conversation then shifted toward climate governance and environmental vulnerability. Roma Mukhtar raised the question of how climate awareness could be integrated directly into housing policy and planning systems instead of remaining a separate environmental concern. Responding to this, Javed Ali Khan situated Pakistan's housing crisis within much larger ecological and climatic transformations. He explained that Pakistan's geography contains an extremely diverse range of ecosystems, stretching from glacial mountain regions to deserts and dense urban centres, and that climate change affects each of these landscapes differently. Rising temperatures are accelerating glacial melt, intensifying floods, increasing urban heat island effects, and placing enormous pressure on already fragile urban infrastructure systems.

Drawing from personal experiences and examples, he described how urban flooding has become increasingly common in cities such as Lahore, Islamabad, and Karachi. He recalled incidents where major roads and urban spaces became completely submerged after rainfall because drainage systems were unable to cope with contemporary urban densities. His broader point was that these are not isolated environmental incidents but symptoms of deeper planning failures. According to him, climate governance should not simply involve emergency responses to disasters but should instead become integrated into every aspect of planning and development, including housing design, settlement planning, infrastructure systems, and city-level governance.

He discussed UN-Habitat's concept of climate-resilient settlement planning, developed in response to the 2022 floods in Pakistan. The concept emerged from the realization that planning approaches often focus too narrowly on individual housing units while neglecting the vulnerability of entire settlements and urban systems. He argued that resilient housing cannot exist independently from resilient infrastructure, drainage systems, water management, and ecological planning. Referring to examples such as the Ravi Riverfront developments and flooding in Islamabad and Rawalpindi, he demonstrated how poorly integrated planning decisions can intensify environmental risks rather than reduce them.

Another major concern he highlighted was groundwater depletion. Through the example of his own experiences in Islamabad, he described how water tables have fallen dramatically over time because of uncontrolled extraction and poor water management. At the same time, floodwaters continue to devastate downstream settlements due to the absence of integrated environmental planning. For him, these contradictions reveal how urban planning systems fail to understand environmental processes holistically. He argued that planning must become more innovative and adaptive, drawing lessons from both historical infrastructure systems and contemporary technological possibilities. Referencing historical gravity-based aqueduct systems, he suggested that older forms of infrastructure often demonstrate forms of environmental intelligence that contemporary planning has forgotten.

The discussion on climate and environmental integration was extended further by Anam Shahid, who focused specifically on environmental governance within housing and planning systems. She argued that environmental concerns are increasingly being incorporated directly into planning policies and regulatory frameworks rather than being treated as afterthoughts. Referring to government initiatives across Punjab, she discussed interventions such as the installation of air quality monitoring systems and PM2.5 sensors to better understand pollution conditions across urban areas. She also explained that environmental approvals for housing schemes increasingly require interventions such as rainwater harvesting systems and wastewater treatment infrastructure before projects can proceed.

Her contribution emphasized that environmental sustainability must become embedded within governance systems themselves. Issues such as urban flooding, water scarcity, pollution, and waste management can no longer be addressed separately from housing and planning policy because they are structurally interconnected. She stressed that policy-level integration is essential if cities are to become resilient to recurring environmental crises. Rather than approaching environmental systems as supplementary technical concerns, she argued that they must become central to the planning process from the beginning.

The discussion then moved toward academia and the relationship between architectural education, research, and implementation. Roma Mukhtar raised the question of how academic research could contribute more effectively to practical policymaking and implementation processes. Responding to this, Dr. Fareeha Tariq challenged the assumption that academia remains detached from reality and practical concerns. She reflected on her own experiences working directly with government institutions on housing projects and policy development, arguing

that academic work only becomes meaningful when it engages directly with implementation and lived realities. She emphasized that one of the greatest failures within architectural education and policy development is the tendency to design for communities without actually understanding how those communities live. Policies and housing designs are often created from privileged positions without engagement with the everyday experiences of low-income populations. She argued that students, architects, and planners must spend time within rural settlements, low-income neighbourhoods, and marginalized communities in order to understand social practices, spatial needs, and economic realities. Without this engagement, housing policies remain disconnected from lived urban conditions.

She described how her own teaching practices intentionally encourage students to work on low-income housing projects rather than exclusively focusing on elite architecture. According to her, architectural education must first teach students how to design dignified and efficient spaces for ordinary people before moving toward more luxurious forms of architectural production. She argued that design is not simply an aesthetic exercise but a social and political responsibility. Architecture, in her view, must emerge from grassroots engagement and participation rather than isolated studio exercises.

The conversation later shifted toward gender-responsive planning and the relationship between housing, health, mobility, and women's everyday experiences. Roma Mukhtar asked what major gaps still exist within Pakistan's housing policies in terms of inclusivity and gender responsiveness. Responding to this, Dr. Fareeha Tariq reflected on how the built environment continues to shape women's participation within both public and domestic life. She argued that many women remain excluded from physical activity, public engagement, and social interaction because urban and housing environments fail to provide safe, accessible, and supportive spaces. Housing, she suggested, must be understood not simply as shelter but as a framework that structures everyday social relations and bodily experiences.

She discussed issues such as women's ownership rights, privacy, accessibility, and physical wellbeing, emphasizing that women's inclusion within housing systems has broader social and economic impacts. Research consistently demonstrates that women reinvest resources into families, education, and community wellbeing, meaning that women's ownership and participation strengthen social systems as a whole. For her, gender-responsive housing requires more than symbolic inclusion; it requires structural changes in policy, planning, ownership systems, and spatial design itself.

Javed Ali Khan extended this conversation by discussing neighbourhood-level planning interventions that attempt to create privacy-sensitive and gender-responsive environments. Referring to examples such as women's enclosures, separate play areas, and multifunctional community parks, he argued that planning must respond to cultural realities and everyday social practices rather than imposing purely technical or abstract solutions. He emphasized that communities themselves often reveal the most important insights about how settlements function and what kinds of spaces are necessary. Books and theories alone, he argued, cannot teach planners how people actually experience urban environments. Genuine understanding emerges only through engagement with lived realities and collective experiences.

As the session approached its conclusion, Roma Mukhtar returned to a question that had remained present throughout the entire discussion: why do policies in Pakistan appear progressive and comprehensive on paper yet repeatedly fail during implementation? This concern became the central thread connecting all aspects of the discussion, from institutional fragmentation and climate resilience to environmental governance, academic engagement, and gender inclusion. The panel ultimately framed housing not as an isolated architectural product but as a complex urban system shaped by governance structures, infrastructure, environmental processes, social relations, and everyday practices. Rather than producing singular solutions, the discussion emphasized the necessity of interdisciplinary collaboration, context-sensitive planning, and sustained engagement with lived realities if the persistent gap between policy and implementation is to be meaningfully addressed.



SESSION 2:

THEME:

TECHNOLOGICAL AND SYSTEMIC INNOVATION IN HOUSING DELIVERY

SESSION 2 :

THEME: TECHNOLOGICAL AND SYSTEMIC INNOVATION IN HOUSING DELIVERY

KEYNOTE :

HOUSING AND OTHER ESSENTIAL SERVICES IN TIMES OF CRISIS SIX REFLECTIONS BEYOND AFFORDABILITY

IGOR MALGRATI

SENIOR INDEPENDENT CONSULTANT, ESSENTIAL SERVICES

In addressing the topic of "housing and other essential services in times of crisis", I will begin by reflecting on a series of situations of crises in which housing is affected, and then turn to six action-oriented reflections that may apply across these situations and that, as the title of this conference suggests, go "beyond affordability".

My name is Igor Malgrati. As a building engineer and urban planner, I have worked for about twenty years in different crisis contexts and with a range of organizations.

This presentation is divided into two parts. First, I will offer a quick overview of the different situations housing may go through during crises. Then, in the second part, I will present six reflections that may be useful across different contexts.

HAVING A PLACE TO STAY IN TIMES OF CRISIS

To begin with, when I use the word crisis, I mean any situation that fundamentally disrupts people's ability to live in safety and dignity. In the case of housing, this is broader than it might first appear.

When we think about housing in times of crisis, one of the most powerful ideas that often comes to mind is destruction, for example housing destroyed by war. But crises affecting housing can also be caused by natural disasters, and increasingly by climate-related events. The major floods that affected Pakistan in 2022 destroyed homes and entire villages. Another familiar situation is that of camps and tents, where displaced populations temporarily settle. In other situations, the crisis is less sudden but equally structural. Housing shortages often lead to the expansion of informal settlements. Today, most of these situations occur where people increasingly live: in cities. Around 60% of the world's population now lives in urban areas, and crises often affect cities directly, as we have seen in places such as Gaza or Teheran, or indirectly through large population movements.



Destruction in Gaza, Source: https://www.reuters.com/pictures/what-gaza-looks-like-today-after-15-months-war-2025-02-11/



Floods in Pakistan, Source: https://www.cdacnetwork.org/policy-briefs/lessons-on-communication-community-engagement-and-accountability-for-the-pakistan-floods-response

The situations I have just mentioned are the ones that most easily come to mind. However, there are also other, less visible, forms of housing crisis that deserve attention. The idea of the camp, although powerful, represents only a small part of the reality. Most people who are forced to leave their homes during crisis do not end up in camps. Instead, a large proportion move into host communities, often with relatives or friends. Another form of crisis is the economic one. After the 2008 financial crisis, many seasonal workers in the United States began moving from place to place and living in vans or mobile homes, illustrating another way in which housing insecurity can appear. Then, there is the situation of homelessness. It happens where there is no house and no safety net, no family or system able to provide temporary shelter. Today, according to some sources, around 300 million people worldwide experience homelessness. Homelessness exists everywhere. Another situation that is rarely on our radar when we discuss housing in times of crises is incarceration. Yet it is also about the spaces where people live. Today, around 11 million people worldwide live in prisons and they often live in overcrowded spaces that lack basic standards.

Looking at all these situations, we realize that housing takes in times of crisis many different forms. Beyond these differences, there are common actions we can take.



Source: Author



Source: https://www.nytimes.com/2026/02/11/world/europe/olympics-homeless-milan.html?unlocked_article_code=1.LlA.8pSF.0BSwGie7aUve&smid=nytcore-ios-share

SIX REFLECTIONS "BEYOND AFFORDABILITY"

These six reflections are action-oriented reflections on how we can build systems that allow people not only to access housing in times of crisis, but also to live in dignity, adapt their homes to their needs, and remain there over time. Each of them will briefly touch upon an example. Some of them are more powerful than others, but all of them are cases I was directly involved in and know from direct experience, while working with organizations such as CESVI, the International Committee of the Red Cross (ICRC), and the United Nation Industrial Development Organization (UNIDO).

The first reflection is that, when we talk about crises, we have to realize that they can take many different forms and, importantly, that they increasingly overlap and are often long-lasting. So when we talk about housing beyond affordability, we must recognize that the systems we design need to last and that we have to get ready before the next crisis hits.

According to Wikipedia, the so-called major wars currently ongoing in the world show that, in 2026, some of these conflicts started 20 or 30 years ago, and some have been ongoing for more than 80 years. At the same time, climate risks are becoming increasingly important. The Notre Dame Global Adaptation Initiative, or ND-GAIN, index measures how exposed over 180 countries are to climate risks and how prepared they are to deal with them. Many of the countries most affected are also those we often see in conflict affected contexts. In general, the environment is increasingly putting pressure on housing. An example from my own country, Italy, comes from Niscemi in Sicily, where environmental risk emerges from the combination of natural conditions, such as sand and clay layers, with intense rainfall and urban development in unstable areas. There, a large landslide forced the evacuation of houses located near the slope, displacing many people. All in all, what we know is that we need to be prepared.

A few measures are particularly important when preparing for crises. These are some of the elements included in the contingency planning for Gaza City, where I was involved in 2019: they include contingency planning, hazard mapping, early warning systems, ensuring that responders and local actors are trained and capable, having ready-made solutions such as decentralized warehouses for materials, and making sure that tools and resources are clearly organized and communicated. What is important to remember is that investing in resilience is always a good investment. Building a resilient housing service and resilient systems that support housing is an important preparedness measure.

The second reflection is that considering the natural environment is no longer optional. For a long time, the environment was considered something infinite or secondary, but that is clearly not the case. Housing that ignores ecological limits contributes to future crises, whether environmental or of another kind, because the environment is the foundation of community lives, livelihoods, and the systems that sustain them.

Traditionally, sustainability has been presented as three pillars: environmental, social, and economic. More recent interpretations, however, suggest something different: the environment is actually the base on which the other two depend. If we look at the Global Status Report for Buildings and Construction, we see that buildings consume about 32% of global energy and contribute roughly 34% of CO_2 emissions. Of course, not all buildings are housing, but most of them are. This means that housing plays a major role in environmental sustainability.

One project in Afghanistan that I was involved in some years ago focused on rebuilding houses and other facilities for returnees. In this project we used materials such as mud bricks, which are local, and timber from sustainably managed forests. Using local resources reduced environmental impact and strengthened the local construction economy. Another example comes from the Philippines. After the 2012 typhoon, many coconut trees had fallen. Instead of treating them as waste, they were used as construction material to rebuild houses. The families who built her own houses received ten new coconut seedlings each, approximately the same number needed to build the house, which were planted, creating a circular approach. That said, while the examples I have presented focused on building new houses, the least environmental impact may come when existing houses are reused, upgraded, or adapted.

The third reflection is that housing must be tailored to the owners and to the context. Not all houses are appropriate for everyone. Sometimes, when we deal with very large numbers of people affected by crises, it becomes tempting to standardize too much. But housing must be comfortable, appropriate to the local climate and culture, durable, and accessible. People must feel that the house truly belongs to them, that it reflects who they are and how they live. We will come back to what it means to protect that belonging.

The housing projects in the Philippines presented earlier offer a useful example. The houses were designed as modules that could be expanded, adapted, and modified over time. The idea was to provide an initial core unit that families could later adapt according to their needs.

The fourth reflection is that there is no affordable housing without equitably accessible services. You cannot place people in houses located in areas without services. When we talk about services, we refer not only to the most technical ones that make the house function, such as water supply, wastewater management, electricity, and solid waste management, but also to services that allow people to live decently, including education and health services. People should not only receive a roof, but a place where they can live a full life. These services also need to be equitably accessible, meaning that people can access them according to their specific needs and capacities.

I like to use the game Mikado to illustrate how interconnected services are. Water supply enables sanitation. Electricity enables both water and wastewater systems. Together, these support health services, education, and other services. Essential services are therefore deeply interconnected and require specific design approach I won't touch upon here.

One example comes from a village in rural Sindh, Pakistan where essential services, together with job opportunities, were provided in flood-affected areas. While housing was supported through separate projects as part of a broader flood response, the project I refer to delivered, in more than one hundred villages across Sindh, equitably accessible essential services such as water, sanitation, roads, public spaces, community centers, and education facilities. One can easily imagine how this may improve quality of life.

The fifth reflection is that affordability is not simply about the money people have; it is also about the relationships and protections that surround them. What does this mean? First, it means that no one is an island. Households exist within communities, and social capital and community cohesion play a crucial role. As much as possible, every housing intervention must be carefully designed to do no harm and, where possible, to actively reinforce the social fabric and community bonds that already exist. Needless to say, proper community participation is crucial for this reflection. Second, social protection mechanisms and legal protections can be the difference between keeping or losing one's home. In regard to legal protection, it can be a tool to enforce security of tenure or it can be explicitly the protection guaranteed by International Humanitarian Law (IHL) in conflict.

Without them, no amount of social capital or community cohesion can prevent someone from losing the place they call home.

Let me briefly mention two examples. In the Philippines project I mentioned earlier, a cash-for-material and cash-for-work approach was used. People were paid to build their own houses and committed collectively to receive cash upon two stages of completion. Every owner legally had the papers for their home, which meant security of tenure from day one. As a small community, there was a strong sense of cohesion. In practice, people helped each other far beyond what was required, reinforcing community cooperation. A family with a person with a disability were helped to build a ramp. Another example comes from Yemen. In this village, after the construction of the water network, the community organized itself so that people contributed according to their capacities. Poorer households did not pay for water, while other families contributed according to the resources they had. This kind of arrangement is possible only when community is cohesive enough.

The final reflection is the most important. In an age of data, advanced technologies, and artificial intelligence, humanity becomes even more important. Behind every project there are human beings. Each person has their own story and, during crisis, has probably experienced hardship and loss. When we engage with this person, there is no other way but to express humanity. While doing that, we will also realize that skills that are sometimes considered "soft," such as empathy, humility, listening, curiosity, and creativity, are in fact crucial enablers.

This is why the importance of humanity is the most important reflection I can leave with you today. It is something I always carry with me, even here, in this room, in this conversation with you. Humanity is what allows us to truly connect with people and to find, together, better systems and better answers.

All in all, when we address housing in times of crisis, we must not forget that housing is about buildings, services, communities, and people. So the question I would like to leave with you is this: if we look ourselves in the mirror, are we ready to address housing in times of crisis?

PAPER 1:

Decentralized Greywater Reuse in Peri-urban Lahore: Feasibility and Socio-Cultural Acceptance in Charrar Pind

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ABSTRACT

Rapid urbanization in Lahore has intensified water scarcity and infrastructure stress, widening the resource gap between formal housing authorities and informal peri-urban settlements. This disparity serves as a fundamental constraint on low-cost affordable housing quality. This paper investigates the feasibility of decentralized greywater re-use in Charrar Pind as a "soft infrastructure" solution to promote infrastructural autonomy and communal well-being.

The research utilizes empirical household survey data (n=104) conducted in 2017, to establish baseline consumption and projected greywater generation. By analysing community perceptions and international paradigms with similar socio-economic constructs, the study explores the potential for a circular water economy within a systemic housing delivery framework for peri-urban contexts.

The analysis reveals that while per capita water consumption in Charrar Pind is lower than standard averages due to faulty fixtures and supply issues, there is a clear appetite for change. Despite the 62% opposition rate among respondents, to greywater re-use, a significant 38% acceptance rate indicates potential for growth through targeted capacity building. Importantly, the low volume of greywater generated renders centralized systems unviable, creating a greater feasibility for low-cost, decentralized household-level solutions that align with prevalent consumption patterns.

The study positions Charrar Pind as a pilot for achieving infrastructural autonomy, validating the unique urban and built character of peri-urban settlements. It advocates for a transition from rigid municipal reliance to flexible, domestic-scale conservation. To support this systemic innovation, the research suggests policy measures including water metering, legislation, and targeted subsidies. Ultimately, integrating decentralized water systems into the housing model ensures that peri-urban settlements remain resilient and dignified, offering a scalable template for sustainable, affordable housing delivery in resource-stressed urban environments.

KEYWORDS:

Systemic Innovation, Peri-urban, Greywater Reuse, Soft Infrastructure, Infrastructural Autonomy, Affordable Housing Delivery, Circular Water Economy, Lahore.

INTRODUCTION:

Peri-urban areas are defined as transition zones between urban and rural landscapes. Depending upon the unique set of socio-economic drivers and patterns of urban growth, their expansion sometimes appears uniform, while at other times it resembles honeycomb structures or displays linear growth along specific corridors (McGregor et al., 2012; Douglas, 2012).



Fig. 1a & b: Satellite image of Leel Pind, Phase 5 & Deo Kalan, Phase 9 town Prism, DHA Lahore (Google Earth)



Fig. 1c: Satellite image of Chung neighbouring Nespak Housing Society, Phase 2, Lahore (Google Earth)

Many peri-urban functions move outwards with the growth of city, whereas some become integrated into the urban fabric as the city expands (Douglas, 2012). Termed as the "Peri-urban Interface", these zones manifest strong urban character along with access to markets, services and labour, yet they simultaneously suffer from acute land shortages, urban congestion, and environmental pollution (Phillips et al., 1999; McGregor et al., 2012).

In the national context of Pakistan, particularly in Lahore, these peri-urban areas are often historic, organic land chunks that remain unintegrated into the surrounding planned housing schemes. The fragmentation of the city reflects an ideological agenda that prioritizes the spatial "restructuring" of the upper-middle class while excluding lower-income groups (Malik, 2018). Gramsci's concept of the "Subaltern" accurately applies to these communities as they struggle with socio-spatial barriers. However, as Roy (2011) asserts, "Subaltern Urbanism" should not be misinterpreted as a place of mere misery; these informal settlements are bustling economies providing both living and livelihood to their inhabitants.

2. PROBLEM STATEMENT:

The built environment in Charrar Pind, an organic settlement now encircled by the grid-planned Defence Housing Authority (DHA), is constrained by inadequate housing infrastructure. This absence of formal planning dictates a morphology that is alien to its modern context, reinforcing infrastructural inequity. However, following Roy's (2011) view of these pockets as "economies of entrepreneurialism," Charrar Pind is a resilient, lively place that defies its projected image of hostility.

The current infrastructural vulnerability presents an opportunity to introduce decentralized greywater (GW) reuse. Rather than a mere technical fix, GW reuse acts as a form of "soft infrastructure", a systemic innovation that moves the discourse 'Beyond Affordable Housing' towards a holistic model of infrastructural equity. This research addresses the conference theme of systemic innovation by investigating how fundamental services can be provided to marginalized pockets without overriding their existing morphology.

. RESEARCH AIM AND QUESTIONS

This research aims to determine how decentralized greywater reuse can be integrated systemically to foster infrastructural 3autonomy in Charrar Pind. It seeks to answer the following:

- How can Charrar Pind adopt greywater reuse as a "soft" intervention to uplift local infrastructure?
- What is the Socio-Cultural acceptance of greywater in Charrar Pind?

4. PAPER STRUCTURE:

The paper is organized into five subsequent sections. Following this introduction, the second section reviews the theoretical framework, focusing on the structure of peri-urban interfaces and greywater as soft infrastructure. The third section details the methodology, focusing on the social survey and morphological analysis of Charrar Pind. The fourth section presents the findings and discussion, interpreting the community's receptivity to technological intervention. Finally, the paper concludes with policy and design implications, proposing a legislative and institutional framework.

for sustainable water management and using it as a tool to uplift the weak infrastructure of Charrar Pind, serving as a case study for peri-urban Lahore.

5. THEORETICAL FRAMEWORK:

5.1 MORPHOLOGICAL CONTINUITY

Kurokawa (1977) compared a city to a living being undergoing metabolism. The organic growth of human settlements evolves and morphs, responding to changes and adapting accordingly. Furthermore, Maki (1964) presented the idea of "group form" within the broader context of collective form. He argued that historic settlements were exemplified by group form that is "generative" in nature and incremental, much like the organic form of peri-urban settlements in the context of Lahore. Maki terms house as the generative unit, asserting that addition of houses to this group form shapes its morphology.



Fig. 2: The contrast between a grid planned neighbourhood (rigid housing units) and the organic morphology of Charrar Pind

5.2 THE FORMAL INFORMAL DIVIDE

Kurokawa (1977) compared a city to a living being undergoing metabolism. The organic growth of human settlements evolves and morphs, responding to changes and adapting accordingly. Furthermore, Maki (1964) presented the idea of "group form" within the broader context of collective form. He argued that historic settlements were exemplified by group form that is "generative" in nature and incremental, much like the organic form of peri-urban settlements in the context of Lahore. Maki terms house as the generative unit, asserting that addition of houses to this group form shapes its morphology.

In the discussion comparing informal and formal urbanism, Hassan (1998) points out that the master plans of most Asian cities fail to represent informal settlements; decisions often lack in-depth understanding and sensitivity to their specific issues. A prevalent class-based categorization in society makes it difficult to design low-cost housing and development empathetically, a divide that often results in land appropriation from the poor (Hassan, 2012; Cermeño, 2021). Furthermore, Hassan (2012) asserts community led initiatives are rarely approved or officially documented, challenging the inclusion of peri-urban areas in formal urban planning.

5.3 DECENTRALIZED GREYWATER SYSTEMS AS "SOFT INFRASTRUCTURE"- SYSTEMIC INNOVATION

The dynamics of peri-urban settlements differ significantly from their grid-planned neighbours. State-led centralized systems, functioning as "hard" infrastructure designed for predictable growth, cannot cater for the vulnerability of the peri-urban interface. Furthermore, integrating typical centralized sewer networks and treatment plants into the current urban fabric including informal peri-urban settlements would be a socioeconomically and technically herculean task (Rubi et al. 2024).

5.4 LOCAL EXAMPLE OF DECENTRALIZED WASTEWATER TREATMENT FOR IRRIGATION:

The success of community-managed systems in Majeed Keeriyo village proves the socio-cultural feasibility of decentralized infrastructure in Pakistan, despite the spatial constraints of a village.



Fig. 3 a, b, c and d: Constructed Wetland in Majeed Keeriyo, Nawabshah, Pakistan (source: Sindhica Reform)

5.5 DOMESTIC WASTE WATER CLASSIFICATION

Type	Source	Characteristics & Contents	Proposed Treatment and Source-Control Measures
Black water	faeces, urine, water	High organic and nutrient content, maximum pathogenic load,	Divert to municipal sewage
Greywater	Excluding toilet wastewater	Reduced organic load, nutrients and pathogens, maximum load of	Directed to treatment systems at or close to source
Light greywater	Personal care and laundry	Increased chemical load from detergent (sodium, nitrates & phosphates,	Minimize chemical load at source to increase treatment efficiency
Kitchen wastewater/ Dark greywater-	Kitchen, dish washing and food preparation	High organic biodegradability- Suspended solids,	Reducing organic waste at source by using grease traps or using screen
Clearwater	warm-up water, Air conditioner or refrigerator	Mostly does not contain any residues or nutrients	Requires no treatment

Table 1: Classification of Domestic wastewater Streams, Adapted from: Roeleveld et al., 2006, Ludwig, 2000, WHO-ROEM 2006

5.5 DOMESTIC WASTE WATER CLASSIFICATION

Category	Benefit in Charrar Pind Context	Beyond Affordable Living	References
Environmental	Reduces freshwater demand, Prevents Stagnant water in streets.	Healthy & Sustainable Environments	Friedler et al. 2010, Environment Agency 2011
Socio-economic	Cost-effective, Low maintenance and can be community led *(36 % reduction was seen in water bills in Cyprus)*	Decentralized, Non-state delivery	Prathapar et al. 2005; Redwood, 2004; Emmerson, 1998.
Morphological	High-density living without massive sewer grids & compromising environmental quality and public health,	Morphological Acceptance	Al-Jayousi, 2004; Prathapar et al., 2005

Table 2: Benefits of Greywater Re-use in Charrar Pind

5.7 KEY CONSIDERATIONS FOR GREYWATER RE-USE IN CHARRAR PIND:

- **Public Health and Safety:** A Significant design consideration is to prevent direct contact with greywater during re-use to mitigate any health risks with direct contact. (Redwood, 2010)
- **Economic foresight:** Technologically over-engineered initiatives can unnecessarily inflate costs, potentially rendering such initiatives unviable for a peri-urban settlement (ibid).
- **Contextual Applicability:** Effective design should remain simple and strictly relevant to the specific environmental and social context of the site (Ludwig, 2015).
- **Operational Efficiency:** Successful treatment systems are characterized by design simplicity and minimal energy requirements for operation (Prathapar et al. 2005).
- **System Reliability:** The greywater treatment Infrastructure must be designed efficiently to receive and treat greywater at any time to accommodate the organic, unpredictable flow of household activities (ibid)

6. METHODOLOGY

6.1 DEMOGRAPHICS AND CONTEXT

Charrar Pind is situated between Phase 1 and Phase 3 of the Defence Housing Authority and houses approximately 20.000 inhabitants. According to the inhabitants, it is a historic village and trace its roots back to the Independence migrations. The urban form shows characteristics of a village with houses in the centre and agricultural land surrounding it, which now has been transformed into the phases of DHA.



Fig. 4: Bird Eye View of Charrar Pind, Source: Sajjad and Malik (2014), tanqeed.org

6.2 AMBIGUOUS JURISDICTIONAL AUTHORITY:

Jurisdictional confusion exists regarding the supply of water and amenities to Charrar Pind. Although physically situated within the Defence Housing Authority (DHA), DHA officials maintain they have no liability to provide for the community beyond shared infrastructure. While the Walton Cantonment Board assumed responsibility for water and sanitation, officials cite regulatory difficulties due to the lack of property tax revenue and maintenance fees. Consequently, the settlement remained disconnected from the primary water supply until recently.

6.3 PHYSICAL FEATURES

6.3.1 STREET HIERARCHY

Charrar Pind exhibits a hierarchical street network where primary streets serve as commercial arteries. They merge into secondary and tertiary streets. While main arteries allow vehicular traffic, widths fluctuate throughout the community with frequent congestion resulting from local encroachments.



Fig. 5: The varying width of streets (Source: Google Earth)

6.3.2 LAND MORPHOLOGY

The land morphology, characterized by sloping streets, indicates the village may have been established on a mound. This is a common feature of historic settlements, which were typically populated on naturally occurring high ground to avoid flooding. Moreover, the resulting incline of the streets encourages smooth, gravity-fed drainage.



Fig. 6 a, b and c: The subtly descending streets



Fig. 7: The clear incline of a street in Charrar Pind

6.3.3 WATER AND SANITATION INFRASTRUCTURE

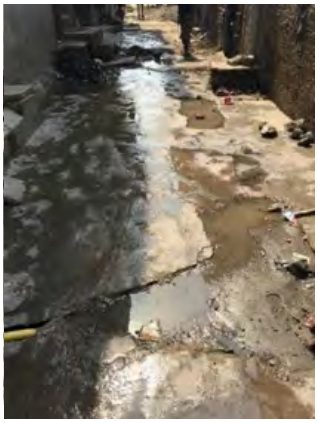
The infrastructure comprising of roads, sanitation, and water lines along with garbage collection system is faulty. Collection of sewer water on streets, missing manhole covers and dilapidated drainage channels are a common sight n the village.



Fig. 8 a, b, and c: manhole, open drains, and clogged drains



Fig.9 a, b, and c: sewage water leakage, sanitation channels



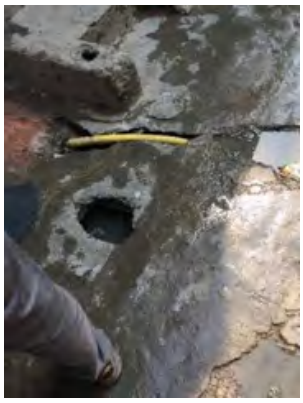


Fig.10 a and b: Existing sanitation and plumbing

6.3.4 SOCIAL, CULTURAL AND ECONOMIC FEATURES

The roads and streets present a mix of urban and rural character. Moreover, communal bonding is strong, manifested by typical "mohalla setup" which is a significant characteristic of organic growth.

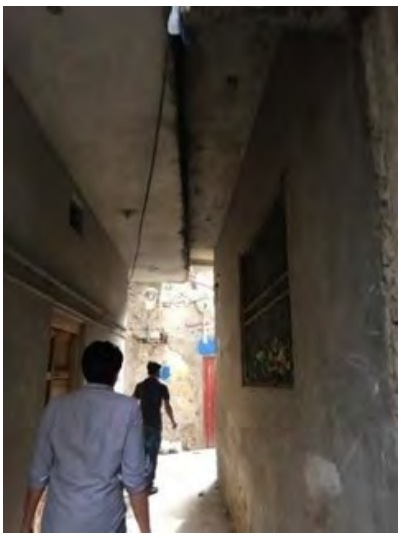




Fig. 11 a, b and c: Close proximity of houses and rural character

The socio-economic profile of the community displays a diverse agglomeration of middle, lower middle and poor classes. Thus, it would not be justified to assume that only the poor working class or house-help inhabits the village.

7. SAMPLING METHOD AND SURVEY DESIGN:

The social survey was designed to recognize the quantities and qualities of freshwater consumption and resultant greywater generation in Charrar Pind. The questionnaire and interviews were initially structured but modified during the survey to better gauge community understanding of water conservation and reuse.

The total number of units in Charrar Pind, according to the Assistant Secretary of the Walton Cantonment Board, is 1,285 (967 residential, 140 commercial, and 170 mixed-use). However, a printed document from the Board enlists 1,114 units with ownership details but no land-use mention. Consequently, the sampling method was based on the 1,114 units. To devise a viable method, we considered 10% of total units regardless of land use, resulting in a sample size of 112.

The survey employed systematic sampling, where samples are equally spaced throughout the population.

The interval, k, is calculated as:

$k = N/n$

$k = 1114 / 112 = 9.946 \approx 10$

With k = 10, every 10th unit was included. The starting point was randomly selected as unit 8; subsequent units were 18, 28, 38, and so on. While the calculated size was 112, the actual coverage reached 104 households. Participants were heads of households or representatives over the age of 18, questioned in person.

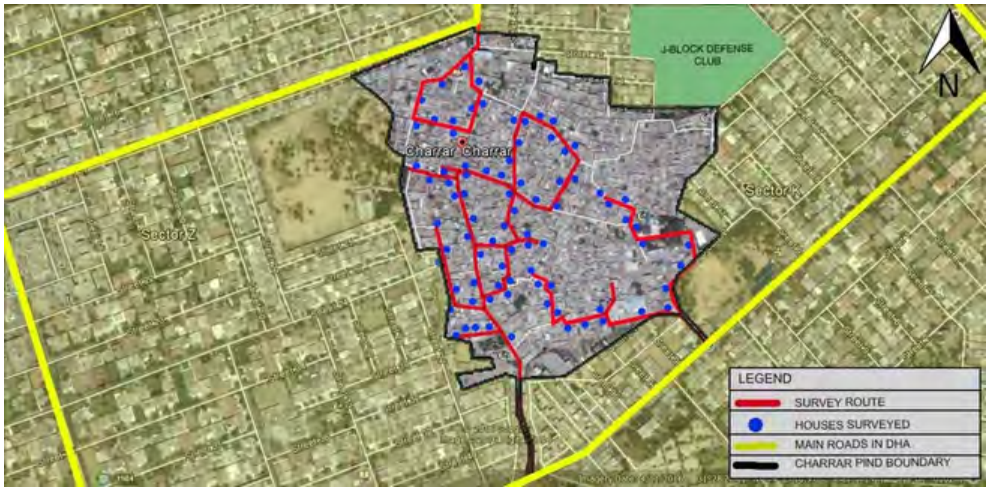


Fig. 12: Survey Route

8 SURVEY FINDINGS AND ANALYSIS

8.1 LAND-USE AND OWNERSHIP PROFILE:

- Out of total units of sample population, 79% were residential and 21% were mixed use developments.
- 88% participants were landlord or owners of the properties, whereas 12% were the tenants.
- Out of these owners inhabited properties, divisions based on inheritance was widely seen in the entire community.
- 63% of households have 6 to 10 inhabitants, 22% households have more than 10 inhabitants and 15% households have 5 or less inhabitants.
- 80% of participants in the sample population were born in the community,12% have been residing for 5 to 10 years in the community and 8% have been residing for less than 5 years.
- 39% properties were 3 Marlas or less, 45% were 5 marla and only 16% were 7 marlas or more.
- Unlike the common perception about the community, the sample population indicated that tenants were outnumbered by the people who are living in their own houses or divided properties.

8.2 GREYWATER REUSE AND PUBLIC PERCEPTION:

8.2.1 IN THE EVENT OF ACCEPTANCE OF GREYWATER REUSE:

- The section of public acceptance in the survey shows that 38% participants from the sample population agreed to using GW whereas, 62% opposed the idea
- The participants who supported GW re-use, chose the following reasons:

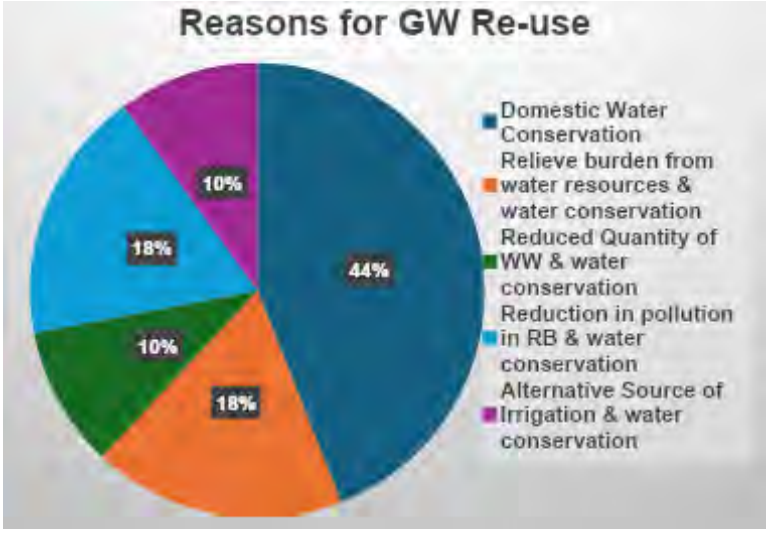


Fig. 13: Reasons for Greywater Re-use

- These percentages, however small, indicate a positive mindset prevalent among the participants about issues like water pollution due to untreated wastewater discharge and alternative water resources etc.
- The Participants who agreed to using GW were environmentally cognizant and wanted to reuse it to conserve water. However, they required the insight, pertinent for its proper reuse and some were even concerned about issues like the long-term effects of greywater on soil and plants.
- For greywater, that has passed preliminary levels of treatments such as filtration and disinfection etc., all the participants who agreed to greywater reuse were willing to use it for toilet flushing. In addition to this, 10% of these participants, also selected irrigation of plants as a reuse application. 7% along with toilet flushing agreed to using it outside the house (such as sprinkling, if no health risk is involved).



Fig. 14: Re-use Applications corresponding to Preliminary Level of Treatment

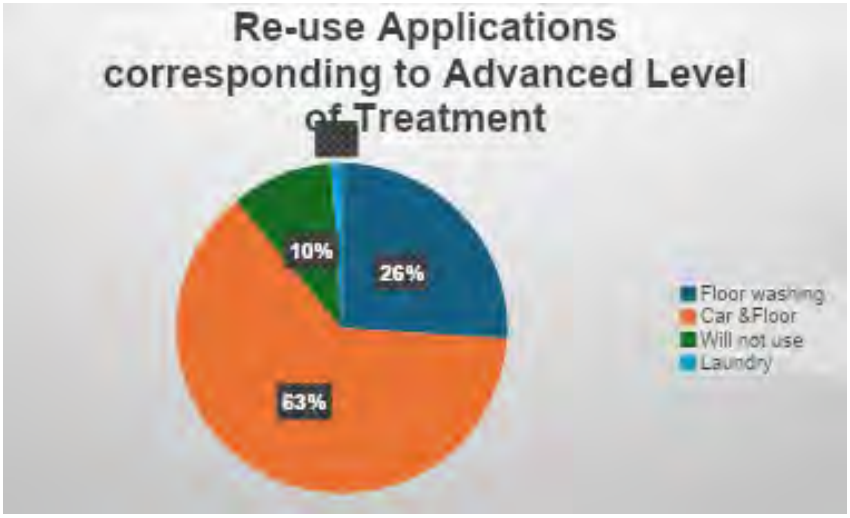


Fig. 15: Re-use Applications corresponding to Advanced Level of Treatment

- The psychological barrier towards greywater re-use is a significant determinant for the acceptance of greywater re-use. The survey results showed that psychological barrier in case of high-level treatment that allows contact, is prevalent but not too strong. This is illustrated by the fact that most participants agreed to use greywater cleaned to a degree at which human exposure is permissible and only 10% altogether refused to use it. This Survey question specifically, was intended to gauge the extent of this psychological barrier.

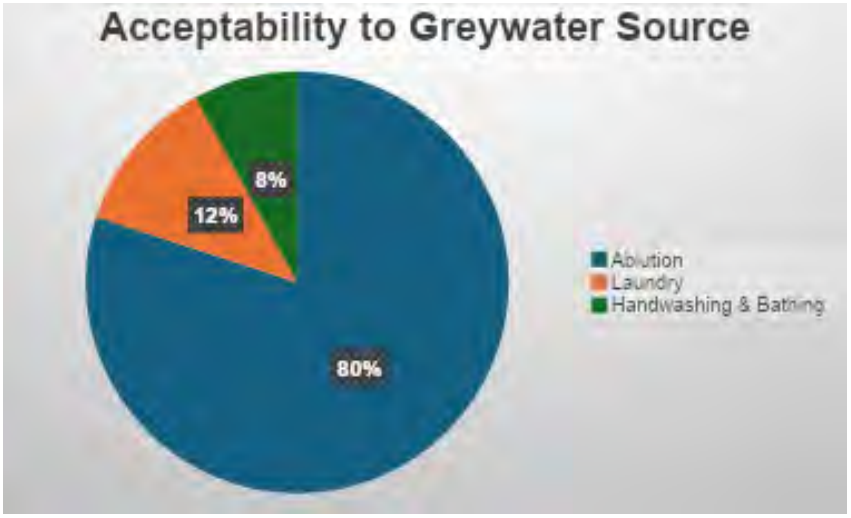


Fig. 16: Acceptability to Greywater Source

73% of participants prefer low-cost primary treatment, 27% opted for high level of treatment for better quality of greywater reuse, whereas none chose the highest level of treatment due to cost concerns.

8.2.2 IN THE EVENT OF NON-ACCEPTANCE OF GREYWATER RE-USE:

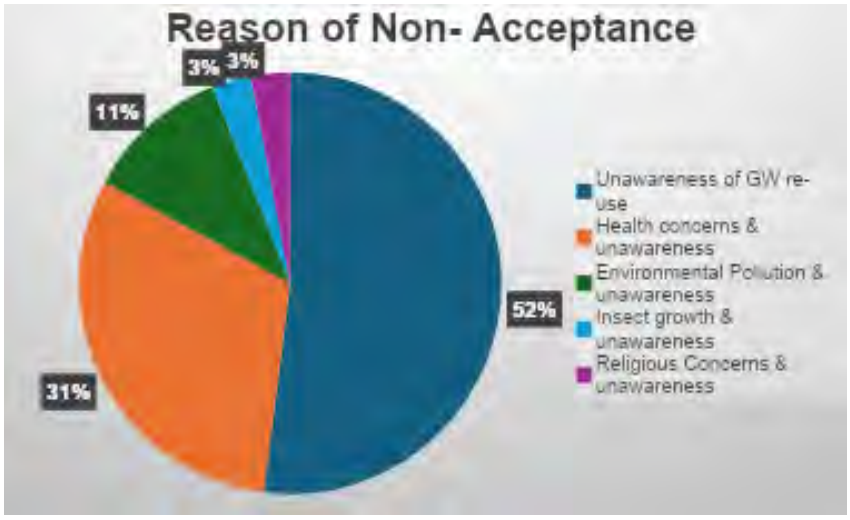


Fig. 17: Reason of non-acceptance

No prior knowledge and health concerns were main reasons for not accepting greywater re-use. Therefore, proper designing, planning and implementation of a context specific grey water system and efficient capacity building is needed.

8.3 WATER CONSUMPTION PROFILE OF CHARRAR PIND:

8.3.1 WATER CONSUMPTION SUMMARY

The water consumption of gallons per day per capita (gpcd) in the sample population of Charrar Pind for the activities enlisted is 23.72. Since most washrooms have partial plumbing therefore, the water consumption also is low.

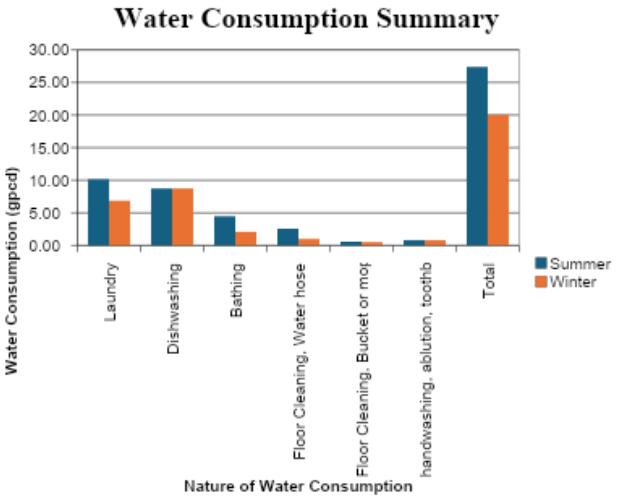


Fig. 18: Water Consumption Summary of Charrar Pind (Bar Chart)

Standard Consumption	US gallons per household per day
House with full plumbing	
Minimum	40
Maximum	60
Partial plumbing (With poor flushing for washrooms)	
Minimum	25
Maximum	35

Table 3: US Plumbing codes

8.4 ASSESSING THE VIABILITY OF SYSTEMIC INNOVATION

The high percentage of participants who currently do not accept greywater reuse is not alarming. Potential for community receptivity and the implementation of greywater initiatives exists; the primary question now is how these solutions will be implemented.

A pragmatic and sensitive approach is required. As survey results demonstrate, labelling an act "illegal" does not prevent its practice, as seen with unauthorized water extraction via boreholes in Charrar Pind. A sound, practical policy could regulate risks and achieve compliance if penalties and incentives are integrated alongside the fulfillment of basic needs.

Notably, many houses have partial plumbing, rarely utilizing flushing devices. If water consumption exceeds 89.7 lpcd (low consumption) even with partial plumbing, it is correct to assert that consumption will rise as economic positions improve and households transition to full plumbing. Limiting water use in a house designed for conservation is simpler than in dwellings lacking access to advanced fixtures, such as low-flow showers or greywater-integrated water closets.

Hence, while specifying a strict per capita daily usage may not be viable, water metering could address unchecked usage and wastage. Given the low projected generation of greywater relative to current consumption, a decentralized reuse initiative is both viable and essential to strengthening the overall infrastructure. Household-level options, including preliminary treatment and diversion devices, can be effectively implemented where large-scale interventions are inapplicable.

9. GUIDELINES AND LEGISLATION FOR GREYWATER REUSE

A comprehensive approach is required to address sanitation and water supply issues in Charrar Pind. Primary indicators for intervention include poor water quality, structural cracks from underground leakage, and the incidence of water-related ailments.

9.1 TECHNICAL GUIDELINES FOR REUSE

9.1.1. DESIGN AND CONTEXT:

Systems must be simple, pragmatic, and context-specific, requiring minimal energy to operate. High-tech solutions often raise costs unnecessarily; thus, risk-reduction measures should be adopted only after a formal hazard assessment.

Recommended Exclusions: Excluding kitchen water is advised due to high organic loads and the persistence of bacteria like E. coli in soil.

9.1.2. IRRIGATION STANDARDS:

Sub-surface irrigation via drip or soil infiltration is the preferred method to minimize exposure. Due to the alkaline nature of greywater, plant compatibility and alternate spreading are necessary to prevent salt saturation.

9.1.3. FILTRATION AND SAFETY:

Appropriate screening in showers and washing machines is essential to reduce solid content and prevent functional failure. Additionally, backflow prevention and clear cautionary signage (e.g., purple-coded "reclaimed water" indicators) must be employed to prevent cross-contamination with potable supply.

9.2. LEGISLATIVE AND INSTITUTIONAL FRAMEWORK

States should incorporate greywater into national water budgets and management plans.

9.2.1. GREYWATER AUTHORITY:

A specialized sub-authority within the Wastewater Department should be established to conduct research, analysis, and risk mitigation. This body would approve reuse applications and provide technical expertise for diversion devices.

9.2.2. BUILDING CODES:

New residences should be designed with bifurcated piping to separate greywater from blackwater streams.

9.2.3. WATER TARIFFS AND METERING:

Transitioning from uniform tariffs to metered, sliding-rate systems is essential to discourage wastage and provide financial relief to low-consumption households.

9.3 COMPLIANCE AND COMMUNITY CAPACITY BUILDING

9.3.1. INCENTIVES AND PENALTIES:

Monetary rebates or free component installations should be offered for compliance, while fines may be issued for systems that compromise public health or environment.

9.3.2. FUNDING MODELS:

Micro-financing and phased implementation, starting with domestic diversion devices before moving to communal infrastructure, can improve viability.

9.3.3. STAKEHOLDER ENGAGEMENT:

Successful implementation relies on a partnership between government, NGOs, and community residents. Taking community elders on board as spokespersons and utilizing school-based awareness campaigns can foster the necessary "political will" and social acceptability for systemic change.

10. INTERNATIONAL PARADIGMS

10.1 DJENNE CITY, MALI:

Dienne City, Mali with 20,000 inhabitants and 30 liters per capita water consumption diverted greywater to infiltration trenches to keep water off streets and recharge groundwater.



Fig. 19 a& b: Before and After the Project implementation in Dienne, Mali, Source: Morel and Diener, 2006

10.2 EIN-AL-BAIDA, TAFILA, SOUTH OF AMMAN

Some two dozen houses were installed with the 4-barrel system in Ain-al-Baida, Jordon. The outcome was 15% reduction in water usage and 30% reduction in water bills. (Morel and Diener, 2006)



Fig. 20: Four barrel up-flow anaerobic filter, Jordan, Source: Morel and Diener, 2006

Four Barrel up-flow anaerobic filter installed in Jordan. The first three barrels (220 liters capacity) filter greywater at different stages and the last barrel provides final storage before application.

11. DISCUSSION: DECENTRALIZED GREYWATER AS SOFT INFRASTRUCTURE AND SOCIAL ACCEPTANCE

The application of technological intervention in vulnerable contexts like Charrar Pind often carries significant socioeconomic implications. It is a unique landscape where residents have historically devised solutions to their problems on a self-help basis, a necessity born from institutional neglect. The survey findings regarding the socio-economic profile indicate a surprising diversity; the community is not merely tenant-based but includes a substantial number of residents who own their land and feel a direct responsibility for its upkeep. While illegal extraction of water via boreholes is a common occurrence, it should be viewed not as a criminal act, but as a survivalist response to a failing centralized system.

The survey pertaining to greywater acceptance suggests that Charrar Pind can be treated as a scalable model. Implementing greywater systems here provides a pathway to impart dignified and quality living without the heavy-handed intervention of traditional engineering. By diverting additional water runoff from the streets into decentralized greywater systems, the community is presented with a clear, visual picture of the benefits: reduced street congestion and improved hygiene. As observed in global precedents, solutions comprising just a few households can utilize decentralized systems that are simple, cost-effective, and require a minimal spatial footprint, a critical factor in Charrar Pind's dense morphology.

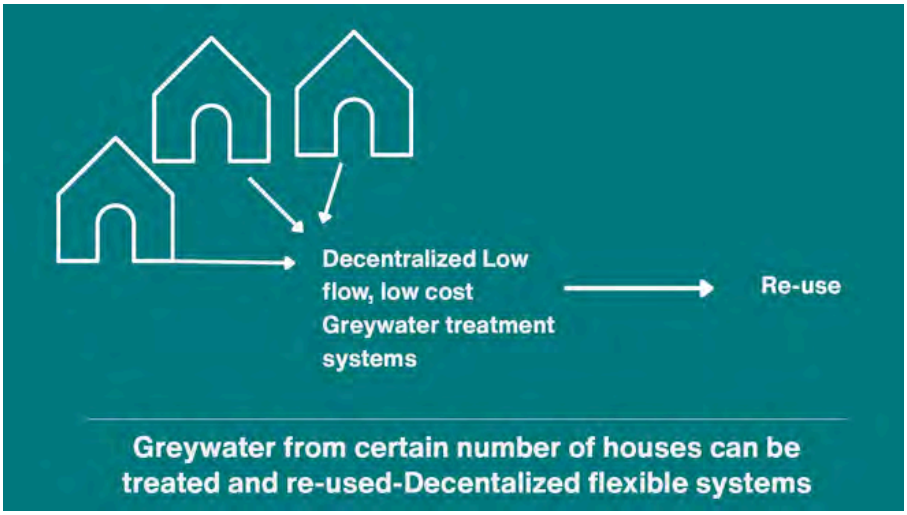


Fig. 21: Schematic for greywater re-use

As done globally, solutions comprising of few households can have decentralized greywater systems that are simple and do not take too much space (Fig. 21).

The general perception of informal settlements, often reflected in literature, is one of intolerance and fear. However, an in-depth analysis of Charrar Pind proves this archetype wrong. In line with Ananya Roy's remarks on Subaltern Urbanism, Charrar Pind demonstrates Bayat's (2021) vibrant "quiet encroachment" where residents are active agents of urban change rather than passive victims. Furthermore, Fumihiko Maki's concept of the generative house unit is highly relevant here; the village operates as a series of incremental housing units that evolve over time.

Charrar Pind is a permanent fixture of the urban fabric, likely to remain as resilient as its high-end neighbourhoods. However, for it to truly thrive, the shift from "hard" infrastructure to "soft" infrastructure is essential. This transition requires design empathy and community capacity building to help the settlement sustain itself. By legitimizing greywater reuse through pragmatic guidelines, we move away from punitive "illegal" labelling and toward a collaborative model of urban resilience.

12. CONCLUSION-GREYWATER REUSE POTENTIAL IN THE BUILT ENVIRONMENT:

This research is inspired by the successful water conservation and community development efforts in countries like Jordan and Oman. Extensive work by the Inter-Islamic Network on Water Resources Development and Management (INWRDAM) over the recent past, provides viable evidence that greywater (GW) reuse is successful in peri-urban and rural areas. While contextual and climatic disparities are undeniable, the religious and socio-economic similarities between these regions and Pakistan make them relevant paradigms for reference.

It would be over-ambitious to imagine that greywater reuse will be immediately embraced by the masses in Charrar Pind. However, it is equally unjust to claim such solutions are unimplementable. The success of GW schemes lies in holistic design that considers the social, cultural, and economic facets of the community. Precedents in Jordan, for instance, were multi-faceted, addressing water conservation alongside poverty alleviation and community empowerment.

In light of the discourse on Charrar Pind, it is correct to assert that greywater should not be viewed as waste, but as an alternative resource. This study creates a starting point for a necessary shift in the urban thought process. The social survey reveals that Charrar Pind, acts as a representative model for communities affected by urban appropriation and the resulting non-fulfillment of basic amenities.

Implementing sustainable initiatives like greywater reuse becomes a tool for creating awareness of the dire need to conserve water in the face of impending shortages.

Resolving the current sanitation crises and the contamination of potable water is a prerequisite. Therefore, a single, pre-conceived solution cannot be put forth; while international paradigms provide guidelines, the initiatives must remain context-specific. This is an evolutionary process informed by changing socio-economic conditions and the singular identity of the Charrar Pind. While GW reuse may not address every facet of infrastructure failure in Charrar Pind, it offers a diversified array of options that allow users to adapt to their specific situations, empowering the community with the agency to remain autonomous.

Ultimately, it is the need of the hour to translate global research into our local context to not only conserve water but accept these peri-urban settlements in the social fabric of cities. It provides an opportunity to facilitate the urban poor, who are often relegated by social dogmas and institutional neglect. This research concludes that the built environment, especially in the less rigid, "subaltern" fabric of Charrar Pind, offers a significant opportunity to realize the potential of greywater as a pillar of urban resilience.

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PAPER 2:

A BIM-Based IF-TMB for Low-Carbon Construction and Sustainable Materials

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ABSTRACT

The global urgency to address climate change, economic instability, and rapid urbanization has intensified the demand for innovative construction strategies that integrate alternative building materials, low-cost solutions, and low-carbon technologies. This research synthesizes methodological, technological, and material-based advancements to propose a comprehensive framework for sustainable and efficient construction. By combining green prefabricated building (GPB) strategies, indigenous resource utilization, and BIM-driven digital construction approaches, the study establishes a multi-dimensional pathway toward environmentally responsible and economically viable built environments. The research integrates innovative GPB and conventional (IF-TMB) systems with cross-case comparative analysis (CCA) to systematically evaluate sustainable construction strategies across diverse climatic, geographic, and socio-economic contexts. The framework is reinforced by life cycle assessment (LCA), sustainable material selection, and digital simulations through Building Information Modeling (BIM). Comparative case evaluations demonstrate that GPB's can reduce lifecycle carbon emissions and energy consumption compared to conventional construction methods.

A core focus of this research is the application of alternative and locally sourced materials. The use of recycled steel, sandwich panels, ultra-high-performance concrete (UHPC), photovoltaic (PV) panels, and advanced insulation systems improves structural durability and thermal efficiency while minimizing embodied carbon. Complementing these industrial innovations, the integration of indigenous materials such as locally sourced stone and traditional construction techniques shows that low-cost and culturally responsive architecture can coexist with advanced energy-efficient technologies. Passive design strategies—including optimized orientation, thermal mass utilization, and natural ventilation—further reduce operational energy loads, particularly in hot climates.

The study highlights the transformative role of BIM-based digital construction strategies in evaluating and optimizing building performance. Through detailed modeling and simulation, BIM facilitates comprehensive carbon emission assessments across multiple lifecycle stages, from material production and prefabrication to on-site assembly, operation, reuse, and post-occupancy evaluation. Digital modeling tools enable precise energy load analysis, carbon tracking, and performance optimization, supporting data-driven decision-making and enhancing construction efficiency. By harmonizing prefabrication, indigenous resource integration, renewable energy systems, and BIM enabled lifecycle analysis, this research establishes a replicable framework for sustainable construction, advancing low-carbon, low-cost building technologies and offering stakeholders a robust decision support strategy for efficient, affordable buildings.

KEYWORDS:

BIM, IF-TMB, LCA, CCA, Digital Construction

INTRODUCTION:

Rising housing demand, driven by urbanization, population growth, and economic pressures, is creating shortages and affordability issues in cities. Climate change is increasing the need for resilient, energy-efficient buildings. Thermal comfort is now key, with a focus on insulation, ventilation, and passive cooling. These challenges are encouraging innovative construction methods like modular design and sustainable materials.

Research proposes the IF-TMB framework, integrating alternative materials, low-cost and low-carbon solutions, green strategies, indigenous resources, and BIM-driven technologies to promote sustainable construction.

Research integrates innovative technologies and conventional (IF-TMB) systems with cross-case comparative analysis (CCA) to systematically evaluate sustainable construction strategies across diverse climatic, geographic, and socio-economic contexts. The major research problems affecting sustainable and modern construction practices. At the center is the construction sector, surrounded by interconnected challenges such as stakeholder resistance, environmental degradation, lack of sustainable construction methods, inadequate waste management, policy and management issues, accommodation shortages, and BIM integration challenges.These problems are closely related and collectively hinder the adoption of efficient, eco-friendly, and technology-driven construction systems. The framework highlights the need for improved policies, digital integration, sustainable practices, and stakeholder collaboration to achieve a more sustainable and effective construction industry.

The study aims to integrate BIM-based digital construction strategies and simulation techniques into both traditional and contemporary buildings to promote green design and sustainable construction practices. It also seeks to evaluate CO_2 emissions through BIM-based digital approaches using custom-designed building analysis, with emphasis on thermal performance, passive systems, and photovoltaic (PV) energy utilization while combining traditional construction techniques with BIM tools. Furthermore, the research aims to develop an IF-TMB framework for sustainable housing adoption through case studies such as Solar Ark 3.0 and Sunshine, addressing barriers, stakeholder involvement, policies, benefits, and effective implementation strategies for sustainable construction.

The framework is reinforced by:

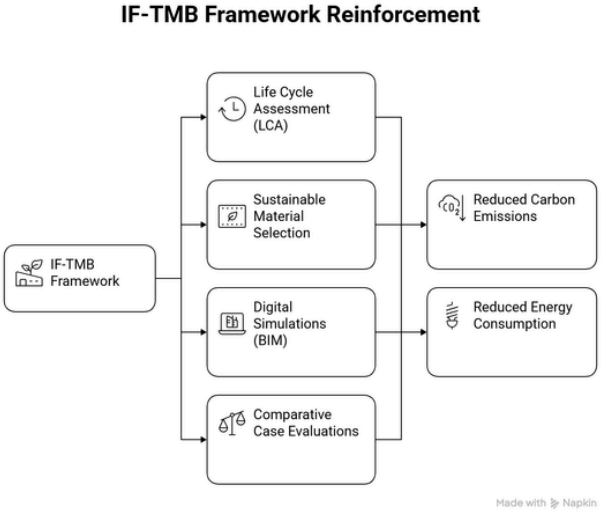


Figure 1 Components of IF-TMB framework
Source: (Drawn by author)

This research emphasizes alternative and locally sourced materials to enhance durability, efficiency, and reduce carbon impact. It combines modern solutions like recycled steel in roof, UHPC, and PV panels with indigenous materials, i.e.: stone, lime and bamboo interior cladding, and traditional techniques for cost-effective, culturally responsive design. Passive strategies such as optimal orientation, thermal mass, and natural ventilation further reduce energy use, especially in hot climates.

This study highlights the role of BIM-based digital construction in optimizing building performance. BIM enables LCA, energy analysis, and performance optimization, improving efficiency from design to post-occupancy.

2. LITERATURE REVIEW

2.1 BUILDING INFORMATION MODELING (BIM)

Building Information Modeling (BIM) is a digital process that involves the generation and management of a building's physical and functional characteristics. BIM is not just software; it is a methodology that integrates people, processes, and technology [1].

BIM is a transformative approach in architecture that shifts design from drawing-based to data-driven processes. It is essential for modern architects, especially in the context of AI-powered intelligent systems. BIM creates a shared

knowledge resource for information about a facility, forming a reliable basis for decisions throughout its lifecycle LCA (from concept to demolition) [2].
Building Information Modeling (BIM) entails the creation and management of digital representations that encapsulate both the functional and physical attributes of a location. This approach anticipates the virtual construction of a facility before its physical realization, aiming to minimize uncertainty, bolster safety measures, tackle issues preemptively, and simulate and evaluate potential outcomes. In the realm of green building, BIM offers construction, engineering, and architectural firms a tool to advance sustainability within the built environment.

2.2 INTEGRATED FRAME WORK FOR TRADITIONAL AND MODERN BUILDINGS (IF-TMB)

The Integrated Framework for Traditional and Modern Buildings (IF-TMB) is a sustainable construction approach that combines traditional architectural knowledge with modern building technologies to improve environmental performance, energy efficiency, and occupant comfort. The framework emphasizes the integration of local construction methods, passive heating and cooling strategies, eco-friendly materials, and digital technologies such as Building Information Modeling (BIM) and Life Cycle Assessment (LCA). Traditional buildings often demonstrate climate-responsive features such as thermal mass, natural ventilation, and locally available materials, while modern buildings contribute advanced engineering systems, digital analysis, and smart construction techniques. IF-TMB aims to bridge these approaches to create resilient, low-carbon, and energy-efficient buildings [3].
The framework supports sustainable design by using BIM-based simulations to evaluate thermal performance, energy consumption, and carbon emissions under different climatic conditions. It also encourages the use of vernacular design principles and sustainable materials to reduce environmental impact throughout the building lifecycle. Through the integration of traditional knowledge and modern digital tools, IF-TMB can assist policymakers, architects, and engineers in developing sustainable housing and infrastructure that are both culturally responsive and technologically advanced. This integrated approach contributes to reducing CO_2 emissions, minimizing energy loads, improving indoor thermal comfort, and supporting green building development in emerging economies and rapidly urbanizing regions [3].

2.3 LIFE CYCLE ASSESSMENT (LCA)

Life-cycle assessment (LCA) methods evaluate the environmental impacts of product or processes, which are crucial to understanding the construction industry's environmental footprint in industrial architecture [4,5]. They also focus on a project's life cycle to accurately depict research scenarios; for instance, prefabricated buildings were compared to ones cast in situ and found to offer cost savings, time efficiency, and reduced carbon emissions [6]. Transportation impacts constituting up to 20% of the total embodied impacts are significant. The following, in accordance with ISO 14040 [6], outlines five stages in the life cycle of prefabricated buildings, namely, material production, transportation, assembling, use, and reuse:

1. In prefab buildings, carbon emissions are produced in six stages, including energy consumption during material production, with the highest-emission stage accounting for 96.2%.
2. Carbon emission factors are computed for machinery and labor for energy consumption, data from the "Standard for Building Carbon Emission Calculation" are preferred.
3. Energy consumption of vehicles during the component transport stage.
4. Consumption of energy and building materials for machinery during field installation.
5. Consumption of building materials during the usage stage.
6. Energy consumption machinery during the demolition stage
7. Artificial carbon emissions of the whole process.

During all these stages, carbon emissions are produced by building materials, machin ery, and labor [7].

2.4 CROSS-CASE COMPARATIVE ANALYSIS (CCA)

CCA is an analysis method that compares examples in order to find patterns, variations, and similarities, frequently employed in qualitative research, it facilitates the comprehension of complex phenomenon in various contexts by extracting insights from several cases studies.

2.5. DIGITAL TECHNOLOGIES AND CONSTRUCTION

Construction in the contemporary era relies on or is transformed into digital construction, looking at digital technologies such as BIM, 3D printing, and the IoT to help improve energy efficiency in green buildings. According to Ref. [9], these tools reshape building design, construction, and management; in this section, we examine their impact on green prefabrication along with digital strategies in the context of building evaluation [10]. Building information modeling (BIM) revolutionizes construction through digital means, as it represents its physical and functional attributes digitally, fostering integrated design and construction collaboration [11]. BIM helps to ensure accurate design, documentation, and resource optimization and enhances sustainability. BIM also aids in life-cycle management, evaluating environmental impacts across the building lifespan [12], while the IoT and smart sensors enhance sustainability in prefabricated buildings by enabling real-time monitoring and the control of factors like energy use and air quality, which reduces energy consumption and ensures occupant comfort in both the construction and operation phases [9]. Digital technologies are revolutionizing green prefabrication, enhancing efficiency and adaptability to environmental aspects and social demands. With integrated design solutions like BIM and AI, these are the tools that drive the construction industry and manufacturing processes towards sustainability [13].

3. METHODOLOGY

3.1 MATERIALS AND METHODOLOGIES

Phase 1: Literature review of green buildings & energy efficiency based on industry data.
Phase 2: Strategy development, site analysis, & design based on user needs, climate, and materials.
BIM-based simulations were used for energy analysis to achieve a sustainable, energy-efficient building by integrating green design, materials, and construction approaches.

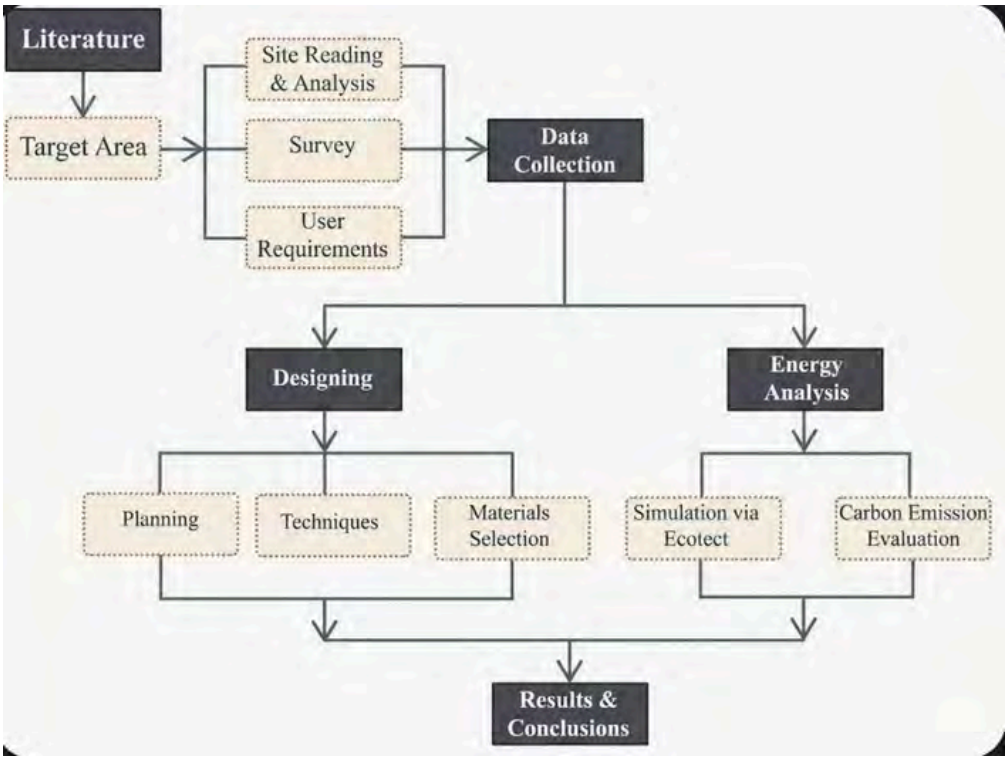


Figure 2 Methodological flow chart framework for building design and energy evaluation. Source: (Drawn by author)

3.2 DATA SOURCE VIA CASE STUDIES

3.2.1 Solar Ark 3.0

Ark 3.0: Advancing Sustainable Architectural Design: emphasizes environmental sustainability through product-oriented architectural design. The project integrates innovative energy & technology solutions to promote sustainable development.

UHPC Shell Design: Lightweight, PB shell manufactured in 5 days & completed within 20 days, avoiding traditional concrete. Parametric design ensures smooth hyperboloid connections & structural consistency.

Advantages: Uses one-third of traditional concrete, is easily transportable, & can be relocated in parts.

Energy Efficiency: PV panels, arranged east-west, maximize energy capture, increasing output by 10%.

Market Potential: Ark 3.0 highlights sustainable design with low-carbon materials & intelligent building technology, focusing on natural energy utilization.



Figure 3 Solar Ark 3.0 China

3.2.3 SUNSHINE ARK

Objective: Renovate a 1970 courtyard house to create a kindergarten & skill training center, revitalizing Tibetan culture & tradition.
Transformation of the courtyard into a multifunctional educational building.

Project Overview: Set an example as a zero-energy building within Tibet's context.

Analysis aims to revitalize the structure by protecting it from environmental threats and improving energy efficiency, including recommendations like PV panels for future energy needs.

Design Strategy: Project devised by five goals: revitalizing the site, balancing green conservation, achieving zero-energy targets, benefiting children & community.

Architectural Design: The renovation uses PB light steel for solar corridors & classrooms. A transparent solar corridor connects the building.

Engineering & Efficiency: Existing structure is preserved & enhanced with PB components for cost-effective efficiency. Sewage treatment & heating combine local materials, reducing energy use and Co2 emissions.
Environmental & Health Considerations: Design uses water recycling, straw insulation, & UV-sensitive films for lighting, improving energy efficiency & indoor air quality.



Figure 4 Sunshine Ark Tibet China

3.3 CROSS-CASE COMPARATIVE ANALYSIS (CCA)

CCA is a qualitative method used to compare cases and identify patterns and insights. Two relevant case studies:

- A Sustainable Supply of Affordable Housing with Prefabrication Technology.
- Sustainable and Affordable Prefabricated Construction: Developing a Natural, Recycled, & Recyclable Mobile Home.

were analyzed based on objectives, methods, and key findings, leading to a resources and skills framework for sustainable construction. While the literature offers a strong theoretical base, integrating surveys and field research can provide more practical insights for future studies.

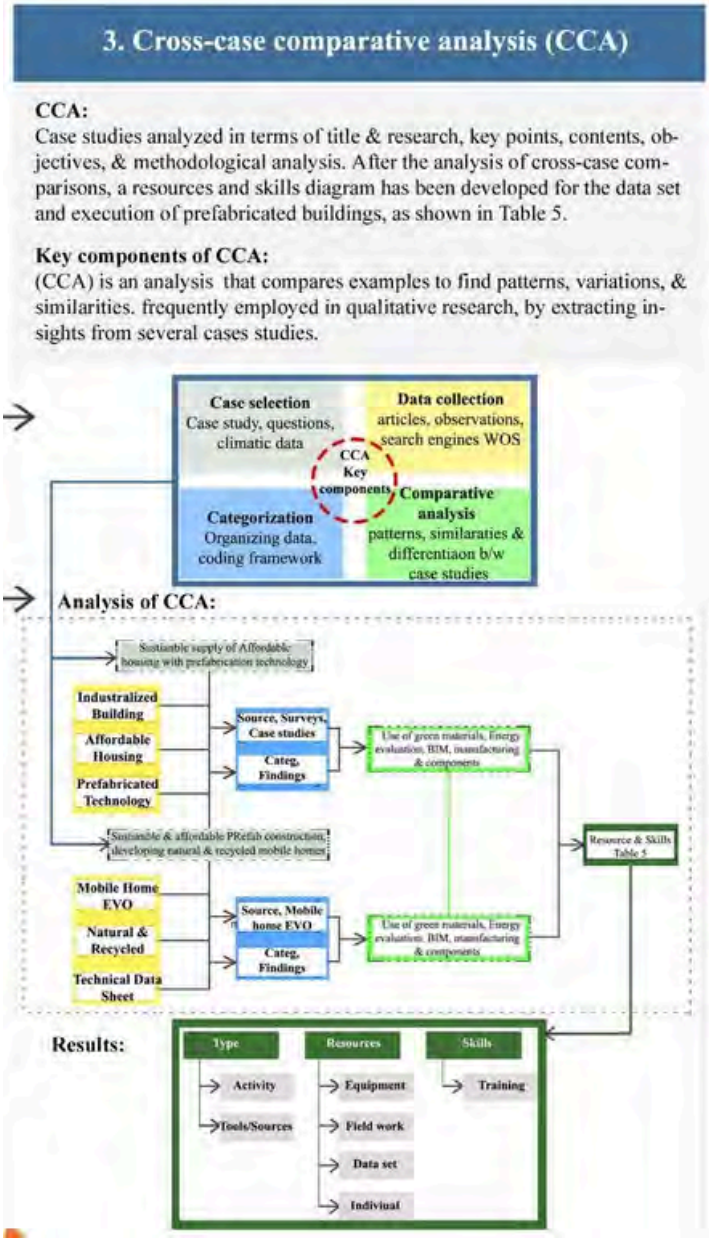


Figure 5 Key components of CCA

3.4 RESEARCH DATA ANALYSIS

3.4.1 CONCEPTUAL FRAMEWORK

Uses PB technology for harsh climates.
Integrates social, cultural, & environmental aspects to ensure eco-friendly design.
Combines industrial efficiency with traditional methods.

3.4.2 BARRIERS TO SUCCESS

Extreme weather limited financial resources.

3.4.3 DISCUSSION

Environmental Benefits: IF-TMB can reduce CO_2 emissions by 20-30%, construction waste by 60%, & raw material usage by 30%. Integration of renewable energy, like PV panels, could enable near-zero energy PB units.
Lessons from Global Cold Regions: Countries like China, USA, & Canada demonstrate to deal in extreme climates.
Policies & Recommendations: Collaboration among government, industry, & communities is key. National standards, public-private partnerships (PPP), & integration of tools like BIM can advance green housing sectors.

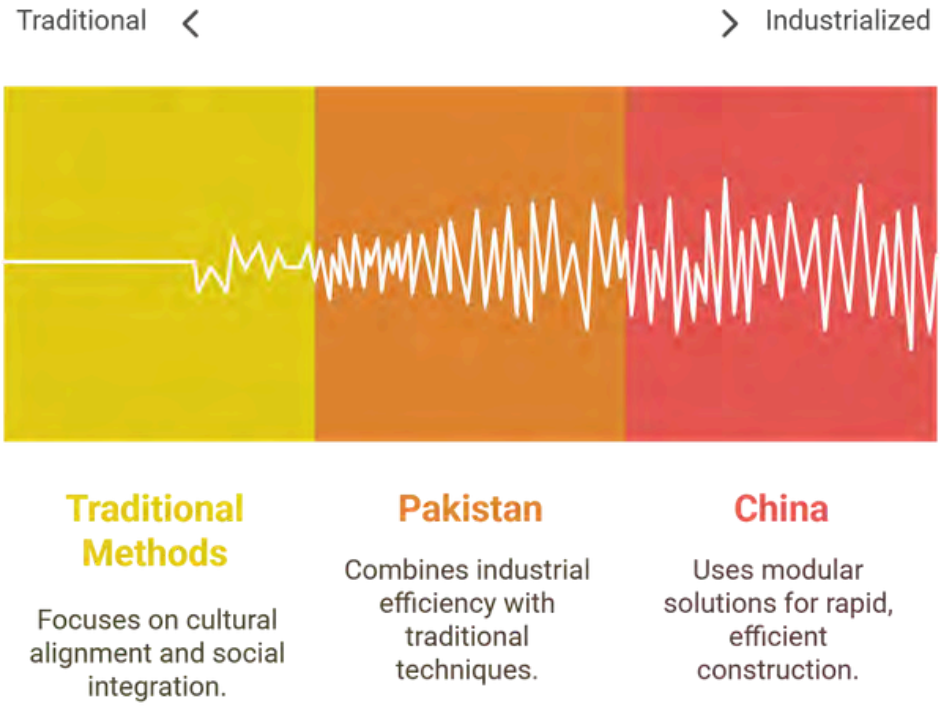


Figure 6 Adoption spectrum from traditional to industrialized methods

4. DESIGN, SIMULATION AND ANALYSIS

4.1 DESIGNING

Low-carbon & energy efficient design strategies using indigenous materials via bim (custom-designed conventional house)
The house one-story floor plan is shown in Figure 7, together with the covered area, open plot area, and spatial dimensions. Brown stone masonry walls, measuring eighteen inches, adorn the external enclosure. Important features include the main entrance, eastward-facing trees that shade and shield the building from the summer sun, and a partially covered north-facing verandah intended for summer use. This design demonstrates how structural elements and natural elements are integrated to improve the comfort and functioning of the home. The detail masonry section of the building is seen in Figure 8 and 9.



Figure 7 Floor planning

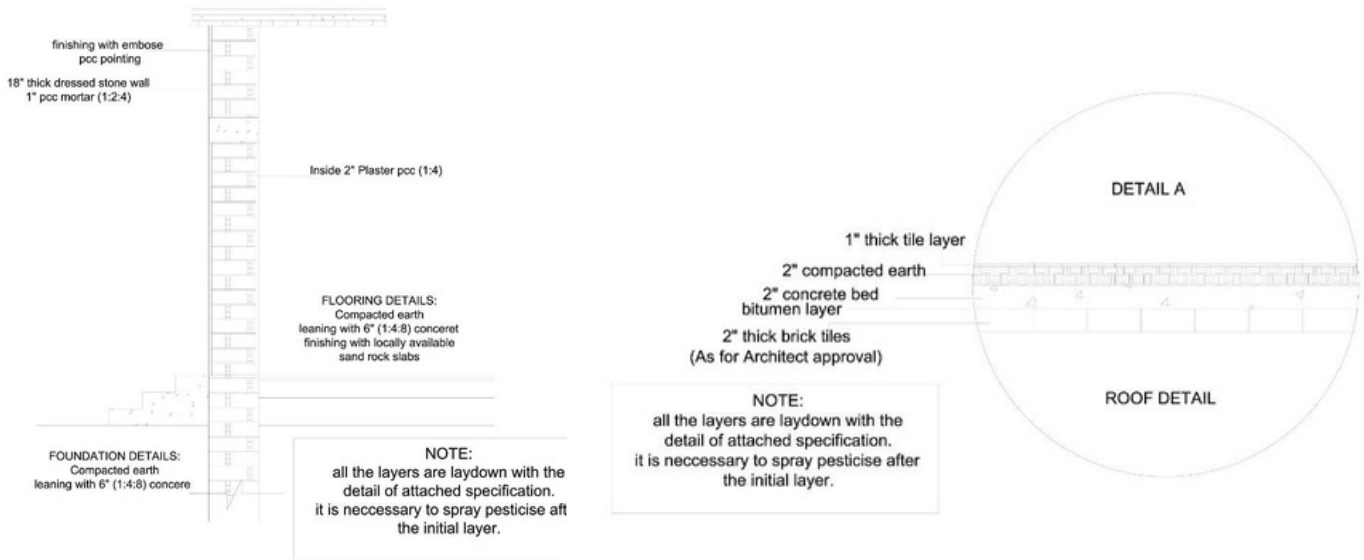


Figure 8-9 Building design and details

4.2 BUILDING SIMULATION

4.2.1 HOURLY TEMPERATURE PROFILE OF THE BUILDING ON THE HOTTEST DAY ANALYZED

Table 1 present data for hottest day (28 May). Results indicate outdoor temperatures reached ~40 °C (12–2 p.m.), while Zone 1 remained around 18 °C, with peak solar radiation (3–5 p.m.) and wind speed (11 a.m.–2 p.m.).

S. No	Hour	Inside	Outside	Temperature Difference
1	0	26	28	−2
2	1	26	27	−1
3	2	26	26	−1
4	3	26	27	−1
5	4	26	26	0
6	5	26	26	0
7	6	26	27	−1
8	7	26	28	−2
9	8	26	30	−4
10	9	26	32	−6
11	10	26	36	−10
12	11	26	37	−11
13	12	26	44	−18
14	13	26	39	−13
15	14	26	40	−14
16	15	26	39	−13
17	16	26	38.5	−12.5
18	17	26	36.7	−10.7
19	18	26	35	−9
20	19	26	31	−5
21	20	26	31	−5
22	21	26	30	−4
23	22	26	30.5	−4.5
24	23	26	29	−3

4.2.2 HOURLY TEMPERATURE PROFILE OF THE BUILDING ON THE COLDEST DAY ANALYZED

Table 2 present the BIM analysis for the coldest day (15 January). Results show outdoor temperatures of 6–10 °C, while indoor zone temperature remained stable at 17–18 °C, with varying solar radiation and wind speed.
Table 2 Hourly temperatures dated Monday, 15 January (coldest day)

S. No	Zone 1	
1	Avg. Temperature	16.6 °C (Ground 26.2 °C)
2	Total Surface Area	69.079 m2 (351.9% flr area).
3	Total Exposed Area	46.660 m2 (237.7% flr area).
4	Total South Window	0.000 m2 (0.0% flr area).
5	Total Window Area	4.181 m2 (21.3% flr area).
6	Total Conductance (AU)	85 W/°K
7	Total Admittance (AY)	364 W/°K
8	Response Factor	3.95

4.2.3 HOURLY GAINS PROFILE OF THE BUILDING ON THE HOTTEST DAY ANALYZED

Table 3 show hourly gains for the hottest day (28 May). HVAC consumption rose from 1000 W (7 a.m.) to 1200 W (12 p.m.), while the indoor zone remained stable.
Table 3 Hourly gain dated Monday, 28 May (hottest)

S. No	Hour	Inside	Outside	Temperature Difference
1	0	18	15	3
2	1	18	15	3
3	2	18	14	4
4	3	18	13	5
5	4	18	11.5	6.5
6	5	18	12	6
7	6	18	11	7
8	7	18	6.1	11.9
9	8	18	13	5
10	9	18	14	4

11	10	18	14.5	3.5
12	11	18	16	2
13	12	18	17	1
14	13	18	17.5	0.5
15	14	18	18	0
16	15	18	18	0
17	16	18	17.5	0.5
18	17	18	17	1
19	18	18	16	2
20	19	18	15	3
21	20	18	14	4
22	21	18	12	6
23	22	18	11	7
24	23	18	11	7

4.2.4 MONTHLY HEATING–COOLING LOAD OF THE BUILDING ANALYZED

Table 4 show monthly heating and cooling loads. Results indicate about 40,000 W heating demand in January and December, while peak cooling demand occurs in May (–340,000 W) and June (380,000 W).
Table 4 Monthly heating–cooling load

S. No	Zone 1	
1	Operation	Weekdays 00–24, Weekends 00–24
2	Thermostat Settings	18.0–26.0 °C
3	Max Heating	666 W at 07:00 on 15 January
4	Max Cooling	1293 W at 15:00 on 3 June

4.2.5 HOURLY GAINS PROFILE OF THE BUILDING ON THE COLDEST DAY ANALYZED

Table 4 shows the hourly gains of the coldest day (15 January). The simulation results indicate that at 7 a.m., the building consumed –250 w for HVAC, and at 8 a.m. it consumed –160 w, while in the afternoon at 12 p.m. it consumed –80 w for HVAC, and the internal zone remained normal.

Table 4 Hourly gains profile graph of the building on 15 January, coldest day in Zone–1, analyzed. Source: (Drawn by author)

S. No	Hour	HVAC (Wh)	FABRIC (Wh)	SOLAR (Wh)	VENT (Wh)	INTERN (Wh)	ZONAL (Wh)
1	0	325	161	0	65	98	0
2	1	269	140	0	31	98	0
3	2	262	134	0	30	98	0
4	3	242	115	0	29	98	0
5	4	176	78	0	0	98	0
6	5	143	45	0	0	98	0
7	6	188	59	0	31	98	0
8	7	247	83	0	65	98	0
9	8	343	111	0	134	98	0
10	9	450	156	0	196	98	0
11	10	674	262	0	314	98	0
12	11	776	310	0	368	98	0
13	12	1120	484	0	537	98	0
14	13	969	429	0	442	98	0
15	14	1112	493	0	521	98	0
16	15	1036	481	0	456	98	0
17	16	1076	569	0	409	98	0
18	17	916	464	0	354	98	0
19	18	844	445	0	301	98	0
20	19	616	355	0	163	98	0

Figure 5 Key components of CCA

21	20	598	350	0	149	98	0
22	21	560	333	0	128	98	0
23	22	537	324	0	115	98	0
24	23	474	289	0	87	98	0
Total	-	13951	6670	0	4925	2356	0

4.3 ANALYSIS AND DISCUSSIONS

The analysis of the building's thermal performance demonstrates the effectiveness of its materials, design strategies, and passive systems in maintaining indoor comfort under varying climatic conditions. The hourly temperature profile on the hottest day shows that the building envelope and construction materials effectively mitigate external heat gain, helping to maintain stable indoor temperatures. Similarly, the hourly temperature profile on the coldest day highlights the role of thermal mass and insulation in retaining indoor heat, thereby reducing dependence on active heating systems. The hourly gains profile on the hottest day indicates how internal and external heat gains correlate with rising outdoor temperatures while still supporting acceptable thermal comfort levels. In addition, the monthly heating and cooling load analysis emphasizes the importance of passive cooling techniques and improved insulation in minimizing summer energy consumption. The hourly gains profile on the coldest day further demonstrates the effectiveness of passive heating strategies and thermal mass in enhancing energy efficiency and indoor thermal stability.

The policy and design implications of this study emphasize the integration of local and traditional construction methods with modern sustainable building practices to improve environmental performance and energy efficiency. The findings suggest that incorporating passive heating and cooling strategies can significantly reduce CO_2 emissions and dependence on mechanical systems. The use of traditional design principles, eco-friendly materials, and Life Cycle Assessment (LCA) approaches supports the development of sustainable and low-impact buildings. Furthermore, the application of BIM-based energy analysis enables designers and policymakers to adapt building designs to varying climatic conditions and optimize performance throughout the building lifecycle. Overall, improving thermal performance and reducing heating and cooling energy loads are identified as key considerations for achieving green, resilient, and energy-efficient construction practices.

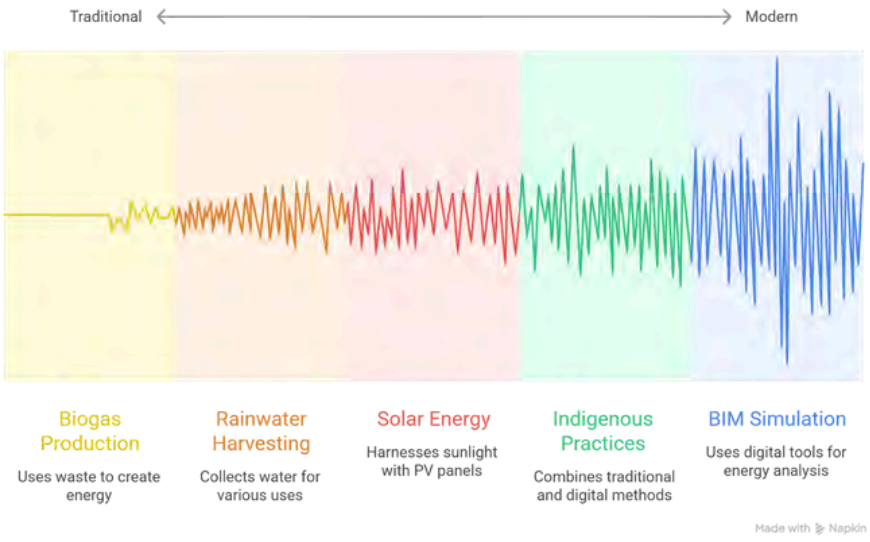


Figure 10 Five major Sustainable & indigenous techniques, enhanced efficiency & IF-TMB strategies

5. CONCLUSION

Based on the key insights, this research concludes that integrating traditional methods (IF-TMB), passive design, eco-friendly materials, and BIM-based analysis can improve thermal performance, reduce energy use and CO_2 emissions, and support sustainable construction.

5.1 PIONEERING GREEN & AFFORDABLE HOUSING THROUGH BIM & DIGITALIZATION

Integrates BIM, LCA, & CO2 emission evaluation across all construction stages. Tools like Ladybug support environmental simulations, along with rhino and grasshopper.

Hybrid methods fosters climate-responsive, low-carbon architecture. Model is suitable for eco-sensitive, specifically in Pakistan.

5.2. SUSTAINABLE MATERIAL INNOVATION & CULTURALLY INTEGRATED DESIGN (IF-TMB) VIA BIM-LCA

Promotes regionally sourced, low-carbon materials like, recycled steel & UHPC, stone & bamboos to align technology with local contexts. Establishes insights for stakeholders, PPP-driven innovation.

5.3 FUTURE DIRECTIONS: AI-POWERED INTELLIGENT GREEN CONSTRUCTION ECOSYSTEMS

Carbon-Energy Dual-Control Visualization Platform for real-time tracking of emissions & energy use. Emphasizing climate-specific design & cultural integration. Also Offers a tech-driven, & culturally meaningful model for sustainable buildings supporting future AI-based, climate-resilient construction practices.

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PAPER 3:

FROM PLOT TO SYSTEM: TOWARD AN ECOLOGICAL MODEL OF AFFORDABILITY HOUSING AS ECOLOGICAL INFRASTRUCTURE IN THE PAKISTANI CONTEXT

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ABSTRACT

Affordable housing in Pakistan remains constrained by a planning paradigm that treats housing as a discrete, cost-minimized product rather than as part of an integrated settlement system. Rooted in mid-20th century subdivision models, this approach prioritizes plot distribution and ownership over environmental performance, social cohesion, and long-term affordability. As a result, housing that is inexpensive to construct often imposes significant long-term costs on residents and the state, including energy demand, water stress, mobility burdens, and infrastructural inefficiencies.

This paper proposes an alternative framework: an ecological model of affordability, in which housing is conceived not as an isolated unit but as part of a settlement-scale system integrating environmental infrastructure, communal space, and incremental growth. Affordability is reframed as a function of long-term resource flows; energy, water, mobility, and social infrastructure, rather than initial construction cost alone.

The argument is tested through a design-research project developed as part of a national affordable housing competition. The project demonstrates how low-rise, high-density housing can be organized through cluster-based planning, blue-green infrastructure, and adaptable unit design to produce socially cohesive and environmentally responsive settlements.

By shifting from plot-based development to system-based thinking, the paper argues for a redefinition of affordable housing as ecological infrastructure, capable of sustaining both human life and environmental systems over time. The research concludes with implications for housing policy, advocating for performance-based planning frameworks that prioritize lifecycle affordability, ecological integration, and social resilience.

INTRODUCTION:

Affordable housing is often framed as a problem of cost, specifically, the cost of constructing individual units. Within this paradigm, success is measured by minimizing per-unit expenditure, optimizing land subdivision, and maximizing numerical delivery. While this approach has enabled the rapid production of housing stock, it has simultaneously obscured a critical dimension: the long-term performance of settlements as lived environments.

In Pakistan, affordable housing delivery remains largely tied to subdivision planning models inherited from colonial and mid-20th century development authorities. These models prioritize plot ownership, road hierarchies, and zoning segregation, while treating infrastructure; environmental, social, and economic, as secondary or external systems. The result is a fragmented urban condition in which housing is physically present but functionally incomplete.

This paper argues that such a model fundamentally misdefines affordability. By focusing exclusively on initial construction costs, it neglects the ongoing expenses borne by residents, including energy consumption, water procurement, transportation, and the social costs of spatial isolation. In this sense, housing that is "affordable" at the point of delivery often becomes expensive to inhabit.

In response, this research proposes a conceptual and spatial shift: from housing as a product to housing as an ecological system. Rather than treating the dwelling unit as the primary object of design, the focus shifts to the settlement as a whole, its environmental flows, spatial organization, and capacity to support collective life.

2. THE LIMITS OF COST-BASED AFFORDABILITY

The prevailing model of affordable housing in Pakistan is rooted in a logic of subdivision and distribution. Land is divided into plots, infrastructure is provisioned incrementally, and housing is constructed either through developer-led schemes or self-built processes. While this model is administratively efficient and financially legible, it produces several systemic limitations.

2.1 FRAGMENTED INFRASTRUCTURE

Infrastructure in plot-based developments is typically conceived as an add-on rather than an organizing principle. Water supply, drainage, and energy systems are often retrofitted, leading to inefficiencies, service gaps, and long-term maintenance challenges. Environmental systems such as stormwater management or microclimate regulation are rarely integrated into the planning process.

2.2 ENVIRONMENTAL STRESS

The absence of climate-responsive design results in settlements that are highly vulnerable to heat stress, flooding, and water scarcity. Buildings rely heavily on mechanical cooling, increasing energy consumption and cost. Hardscaped environments exacerbate urban heat island effects, further degrading living conditions.

2.3 MOBILITY BURDEN

Plot-based schemes often prioritize vehicular access over walkability, resulting in dispersed urban forms that necessitate long commutes. This increases both economic and environmental costs, particularly for low-income households.

2.4 SOCIAL FRAGMENTATION

Perhaps most critically, the spatial logic of individual plots undermines the formation of shared space. Streets function primarily as circulation corridors rather than social environments, and opportunities for collective life are limited. This has implications for safety, especially for women and children, as well as for broader patterns of social cohesion.

3. THE CONCEPTUAL GAP

At the core of contemporary affordable housing discourse in Pakistan lies a fundamental conceptual limitation: the persistent definition of housing as a discrete, deliverable product. This definition, while administratively convenient and financially legible, constrains the scope of both design and policy by reducing housing to a bounded object, measurable in terms of unit cost, physical dimensions, and numerical output.

Within this framework, the success of a housing project is typically evaluated through metrics such as cost per square foot, number of units delivered, and speed of construction. These indicators, while not insignificant, privilege quantifiable outputs over qualitative and systemic performance. As a result, the broader conditions that enable habitation, environmental stability, access to shared resources, and the capacity for social life, are relegated to secondary concerns or treated as externalities.

This conceptualization is not incidental but historically produced. The planning apparatus that governs housing delivery in Pakistan is deeply rooted in mid-20th century models of land subdivision and administrative control, reflecting broader modernist planning paradigms that prioritize order, standardization, and legibility (Scott 1998). Development authorities operate through standardized byelaws that emphasize plot demarcation, road hierarchies, and zoning regulations. These instruments were originally designed to facilitate orderly expansion and regulate land markets, but they have had the unintended effect of fixing the plot as the primary unit of urban organization.

The dominance of the plot produces a spatial logic in which housing is understood as an aggregation of individual parcels rather than as a relational system, limiting the capacity for incremental and participatory forms of development (Habraken 1972). Each plot is conceived as a self-contained entity, responsible for accommodating its own built form, services, and economic value.

The implications of this model become particularly evident when examined through the lens of affordability. By isolating the housing unit from its broader context, the cost of construction is foregrounded as the primary determinant of affordability. However, this narrow focus obscures the cumulative burden of operational costs that emerge over time. These include expenditures on energy for cooling, water procurement in the absence of reliable supply, transportation necessitated by dispersed urban form, and private solutions to infrastructural deficiencies.

In effect, the current model externalizes a significant portion of housing costs onto residents. What is presented as affordability at the point of purchase is often offset by ongoing expenses that disproportionately affect low- and middle-income households. This misalignment between initial cost and long-term expenditure reveals a critical flaw in the prevailing definition of affordability: it is temporally short-sighted and systemically incomplete.

Beyond its economic limitations, the product-based conception of housing also has profound spatial and social consequences. By prioritizing individual ownership and enclosure, it undermines the formation of shared environments. Streets, which might otherwise function as spaces of interaction and exchange, are reduced to channels of circulation. Open spaces, when present, are often residual or poorly integrated, lacking the spatial definition necessary to support sustained use.

This erosion of shared space has implications for social life, particularly in contexts where informal networks play a crucial role in everyday survival. The absence of accessible, well-defined communal areas limits opportunities for interaction, weakening the social fabric that underpins collective resilience. Issues of safety, especially for women and children are exacerbated by spatial configurations that lack visibility and proximity.

At the same time, the product-based model tends to privilege technical and financial solutions over experiential and environmental considerations. Engineering systems are often deployed to compensate for deficiencies in spatial design, resulting in an overreliance on mechanical cooling, artificial lighting, and centralized infrastructure. While these systems can provide short-term functionality, they introduce long-term dependencies that are both economically and environmentally unsustainable.

Equally significant is the marginalization of phenomenological dimensions of housing, the qualities of light, air, materiality, and spatial experience that shape how environments are perceived and inhabited. In the pursuit of efficiency and standardization, these aspects are often overlooked, leading to environments that are technically functional but experientially impoverished. This has implications not only for comfort but also for dignity, identity, and the sense of belonging that housing is meant to provide.

The conceptual gap, therefore, is not simply a matter of missing components but of a fundamentally limited framework. By defining housing as a discrete product, the current model excludes the systems that sustain it, separating the dwelling from the social and spatial processes through which space is collectively produced (Lefebvre 1991). It separates the dwelling from the ecological processes that sustain it, the infrastructural networks that support it, and the social relationships that give it meaning.

Addressing this gap requires a redefinition of housing as a relational and systemic condition. Rather than treating the dwelling unit as the primary object of design, attention must shift to the settlement as a whole; its spatial organization, environmental performance, and capacity to support collective life. In this expanded view, housing is understood not as an isolated artifact but as part of a continuous field of interactions between people, resources, and space.

This shift has significant implications for how affordability is conceptualized. If housing is a system, then affordability cannot be reduced to the cost of its components. It must instead be understood as the efficiency and equity with which the system distributes resources and opportunities. A settlement that reduces energy demand through passive design, that manages water locally, and that supports social networks capable of sharing resources may, over time, prove far more affordable than one that minimizes construction cost but relies heavily on external inputs.

Importantly, this redefinition does not reject the economic dimension of housing but situates it within a broader framework. Cost remains a critical factor, but it is no longer the sole determinant. Instead, it is considered alongside performance, adaptability, and resilience. This allows for a more nuanced understanding of value, one that recognizes the long-term benefits of investing in environmental and social infrastructure.

The ecological model of affordability proposed in this paper emerges directly from this reconceptualization. By framing housing as an integrated system, it seeks to align spatial design with environmental processes and

social practices. It positions the settlement—not the individual unit—as the primary site of intervention, and it evaluates success not only in terms of delivery but in terms of sustained performance. in doing so, it also opens up new possibilities for design. Freed from the constraints of the plot-based model, planners and architects can explore alternative forms of organization, such as cluster-based layouts, shared infrastructures, and landscape-driven frameworks. These configurations allow for greater flexibility, enabling settlements to evolve over time in response to changing conditions.

Ultimately, bridging the conceptual gap requires a shift not only in design practice but in institutional thinking. It calls for planning frameworks that prioritize relationships over objects, performance over output, and systems over components. Only by expanding the definition of housing in this way can affordability be addressed in a manner that is both meaningful and sustainable.

4. TOWARD AN ECOLOGICAL MODEL OF AFFORDABILITY

The redefinition of affordability proposed in this research requires a shift from static measures of cost toward a more dynamic understanding of housing as a system of relationships. Rather than conceiving affordability as the minimization of initial capital expenditure, it must be understood as a function of how effectively a settlement mediates the flows of resources necessary for daily life. These include energy, water, mobility, and access to shared infrastructure, all of which have direct economic implications for residents.

In this sense, affordability is not a fixed attribute of a housing unit but an emergent condition produced by the interaction between built form, environmental systems, and patterns of use. A dwelling that minimizes construction cost but relies heavily on mechanical cooling, private transport, or purchased water may, over time, impose a significantly higher financial burden than a slightly more expensive unit embedded within a well-performing ecological system.

The ecological model of affordability therefore shifts the focus from unit cost to lifecycle performance. It asks not only how much a house costs to build, but how much it costs to inhabit over time. This temporal dimension is critical, particularly in contexts such as Pakistan, where infrastructure provision is uneven and households often bear the responsibility for compensating for systemic deficiencies.

Within this framework, design becomes a means of reducing long-term dependency on external systems. Spatial configurations that promote passive cooling reduce energy demand; integrated water systems reduce reliance on municipal supply; walkable layouts reduce transportation costs. These are not supplementary features but central determinants of affordability.

This shift toward lifecycle performance resonates with growing critiques of conventional sustainability metrics, which often prioritize technological efficiency over spatial and social integration (Guy and Farmer 2001).

At the same time, the model recognizes that affordability is not purely material. Social and spatial conditions such as access to shared space, proximity to neighbors, and the ability to participate in collective life also contribute to the overall viability of a settlement. These factors influence safety, mental well-being, and the capacity for informal support networks, all of which have indirect but significant economic implications.

The ecological model of affordability thus operates across multiple scales, from the individual dwelling to the settlement as a whole. It positions housing as a form of infrastructure, not only in the technical sense, but as a system that supports and sustains everyday life.

5. FROM PLOT TO SYSTEM

The transition from a plot-based model to a system-based approach represents a fundamental reordering of planning priorities. In conventional development practice, land is first subdivided into discrete parcels, after which infrastructure and services are provisioned in a sequential manner. This process establishes the plot as the primary unit of organization, with each parcel functioning largely independently of its surroundings.

While administratively efficient, this model produces a fragmented spatial condition in which relationships between units are weakly defined. Streets are designed primarily for vehicular movement, open space is residual rather than intentional, and environmental systems are treated as external utilities rather than integral components of the urban fabric.

In contrast to subdivision-based planning, a system-oriented approach aligns with landscape urbanism perspectives, which position ecological processes as primary structuring elements of urban form

(Waldheim 2006). These may include hydrological patterns, prevailing wind directions, solar exposure, and topographical variations. Rather than imposing a rigid grid onto the site, the design responds to these conditions, using them to organize movement, define boundaries, and structure habitation.Within this framework, landscape assumes a primary role. It is no longer conceived as an amenity or decorative layer but as an operational system that manages water, moderates temperature, and shapes spatial experience. Circulation networks, particularly pedestrian pathways are aligned with these environmental systems, creating a cohesive structure in which movement, ecology, and habitation are interdependent.

Housing is then organized into clusters that respond to this larger framework. These clusters are not isolated units but components of a continuous system, linked through shared spaces and infrastructural networks. The emphasis shifts from individual ownership to collective performance, with the quality of the settlement determined by the strength of relationships between its parts.

This reconfiguration has significant implications for how density is understood. Rather than equating density with verticality, the system-based model explores the potential of low-rise, high-density configurations, where compactness is achieved through spatial organization rather than building height. This allows for greater accessibility, stronger connections to the ground, and more effective integration of environmental systems.

6. DESIGN RESEARCH: PROJECT AS PROTOTYPE

The theoretical framework outlined above is tested through a design-research project developed as part of a national affordable housing competition. Rather than presenting the project as a finalized solution, it is positioned as a prototype, a speculative yet grounded exploration of how the ecological model of affordability might be spatialized within a specific context.

The competition brief called for the development of a low-cost housing scheme, with an emphasis on scalability and replicability. While many submissions approached the problem through optimization of unit design or construction techniques, this project reframed the brief at the level of the settlement. The question was not simply how to design an efficient dwelling, but how to structure an environment in which affordability could be sustained over time.

This shift in focus informed all subsequent design decisions. Instead of beginning with the housing unit, the project began with the identification of environmental systems and spatial relationships that could support collective life. The resulting proposal prioritizes settlement structure over architectural form, using the design of space as a means of organizing social and ecological processes.

In this sense, the project operates as a form of design research, where the act of designing becomes a method of inquiry. It allows for the testing of hypotheses such as the relationship between cluster organization and social cohesion, or between water systems and microclimate performance in a spatially explicit manner.

7. SITE AND CLIMATE AS GENERATORS

The project site is located within a region characterized by high temperatures, seasonal humidity, and increasing water stress. These conditions are not unique but representative of broader climatic challenges facing many parts of Pakistan. Rather than treating these factors as constraints to be mitigated, the design approach positions them as generative forces.

This shift in perspective is critical. When climate is understood as an external problem, solutions tend to be additive mechanical cooling systems, imported materials, or infrastructural interventions that operate independently of spatial design. When climate is integrated into the design process as a generative force rather than a constraint, it enables forms of passive environmental control that reduce dependence on mechanical systems (Olgyay 1963).

In the proposed settlement, solar exposure is managed through the orientation of streets and the placement of vegetation, creating shaded pathways that reduce heat gain. Prevailing wind patterns are used to facilitate cross-ventilation, enhancing thermal comfort within dwellings. Water, rather than being treated solely as a resource to be supplied, is incorporated into the landscape through retention and reuse systems that contribute to both ecological performance and spatial quality.

This approach transforms the site from a neutral surface into an active participant in the design process. The resulting settlement is not imposed upon the landscape but emerges from it, aligning built form with environmental conditions in a way that enhances both performance and experience.

8. SETTLEMENT STRUCTURE AND MASTER PLANNING

The master plan is organized around a continuous blue-green infrastructure framework, which integrates water management, vegetation, and circulation into a cohesive spatial system. This framework serves as the primary ordering device, structuring the distribution of housing, defining movement patterns, and establishing the ecological logic of the settlement.

Water plays a central role in this system. Rather than relying exclusively on underground drainage networks, the design incorporates surface-based water retention and filtration strategies. These include bioswales, retention basins, and planted channels that capture and manage stormwater while contributing to microclimate cooling. By making water visible and spatially present, the design also fosters a greater awareness of resource use among residents.

Circulation is organized through a hierarchy that prioritizes pedestrians over vehicles. Primary pathways follow the contours of the landscape and align with environmental systems, creating shaded, walkable routes that connect housing clusters to shared amenities. Vehicular access is accommodated but deliberately limited, reducing the dominance of cars within the settlement.

Housing clusters are distributed along this infrastructural network, each forming a semi-autonomous unit within the larger system. This allows for a balance between collective integration and localized identity, enabling residents to experience both a sense of community and a degree of spatial autonomy.

9. HOUSING CLUSTERS AS SOCIAL INFRASTRUCTURE

At the heart of the settlement are the housing clusters, which function as both spatial and social units. Each cluster is organized around a shared open space typically a courtyard or a widened pedestrian street that serves as a focal point for daily activity.

These spaces are designed to support a range of uses, from informal gathering and play to small-scale economic activities. Their proximity to individual dwellings ensures a high degree of visibility, enabling passive surveillance and enhancing safety, particularly for children and women. This spatial arrangement fosters a sense of collective ownership, where residents are both users and custodians of shared space.

The emphasis on cluster-based organization reflects long-standing observations that spatial proximity and shared environments are critical to the formation of social networks and collective life (Gehl 2011). Relationships between neighbors are facilitated not through formal programming but through the everyday use of shared environments.

This has implications for resilience. In contexts where formal support systems may be limited, the presence of strong social networks can provide critical forms of assistance, from childcare to resource sharing. In this sense, the cluster operates as a form of social infrastructure, complementing the ecological systems that support material life.

10. INCREMENTAL HOUSING AND ECONOMIC ADAPTABILITY

A key component of the project is the design of housing units as incremental systems. The concept of incremental housing draws on precedents in participatory and adaptable design, where housing is understood as a process rather than a finished product (Turner 1976). Rather than delivering a fixed, complete dwelling, the initial unit provides a basic framework that can be expanded over time. This reflects both economic realities and cultural practices, where households often grow and change in response to shifting needs.

The incremental approach allows residents to invest in their homes gradually, reducing the financial burden at the point of entry. It also enables the incorporation of income-generating activities, such as rental rooms or small businesses, which can contribute to household resilience.

From a design perspective, this requires careful consideration of structural systems, circulation, and service provision. The initial layout must anticipate future expansion, ensuring that additions can be made without compromising spatial quality or environmental performance. This transforms the dwelling from a static object into a process, capable of adapting over time.

11. ENVIRONMENTAL SYSTEMS AND MICROCLIMATE

Environmental systems are embedded within the spatial structure of the settlement, rather than applied as technical add-ons. These systems operate at multiple scales, from the individual dwelling to the settlement as a whole, creating a layered approach to climate responsiveness.

At the micro-scale, building orientation, shading devices, and material selection contribute to thermal comfort. At the meso-scale, vegetation and water systems create localized cooling effects, reducing ambient temperatures within clusters and along pedestrian routes. At the macro-scale, the overall layout of the settlement minimizes exposure to harsh climatic conditions while maximizing opportunities for natural ventilation.

Water management is particularly critical. Greywater is reused for irrigation, reducing demand on freshwater supplies, while stormwater is captured and stored within the landscape. These strategies not only improve resource efficiency but also enhance the spatial quality of the environment, introducing elements of water and vegetation that contribute to a more habitable and engaging landscape.

12. URBAN METABOLISM

The framing of the settlement as a system of flows aligns with the concept of urban metabolism, which understands cities as dynamic systems of resource exchange (Kennedy, Cuddihy, and Engel-Yan 2007). Rather than viewing infrastructure as a set of discrete components, it emphasizes the movement of resources through the urban environment.

In the proposed model, these flows are made visible and, where possible, localized. Water is captured, stored, and reused within the settlement; energy demand is reduced through passive design; mobility is minimized through compact planning. Food production, while limited in scale, is incorporated through productive landscapes that contribute to both sustenance and community engagement.

By internalizing these flows, the settlement reduces its reliance on external systems, enhancing resilience in the face of infrastructural uncertainty. At the same time, it fosters a greater awareness of resource use, encouraging more sustainable patterns of behavior.

13. IMPLICATIONS FOR POLICY

The ecological model of affordability outlined in this research necessitates a corresponding shift in housing policy and planning frameworks. While design strategies can demonstrate alternative spatial possibilities, their broader impact remains limited without institutional mechanisms capable of supporting and scaling such approaches. The persistence of plot-based development in Pakistan is not simply a matter of design preference but is embedded within regulatory structures, financial models, and administrative practices that collectively shape how housing is delivered.

To move from isolated prototypes to systemic change, it is necessary to examine how existing policy frameworks constrain the integration of ecological and social systems, and to identify pathways through which these constraints can be reconfigured.

13.1 LIMITATIONS OF EXISTING POLICY FRAMEWORKS

Current housing policy in Pakistan operates through a set of instruments that prioritize land subdivision, ownership, and numerical delivery. Development authorities typically regulate housing through zoning ordinances and byelaws that define plot sizes, road widths, building setbacks, and land use categories. While these tools provide a degree of standardization and control, they also reinforce a spatial logic that fragments the settlement into discrete units.

One of the primary limitations of this framework is its emphasis on the plot as the fundamental unit of planning. By structuring development around individually owned parcels, the system inherently privileges privatized space over shared infrastructure. Open space requirements, when present, are often treated as residual allocations rather than as integral components of the settlement structure. Similarly, environmental systems such as water management, vegetation, and microclimate regulation are rarely embedded within the planning process, instead being addressed if at all through engineering solutions applied after subdivision.

A second limitation lies in the separation of infrastructure from spatial design. Water supply, drainage, and energy systems are typically planned and implemented as technical services, independent of the spatial organization of the settlement.

This results in inefficiencies and missed opportunities for integration, where environmental systems could otherwise contribute to both performance and spatial quality.

Third, the prevailing model relies heavily on output-based metrics, such as the number of units delivered or the cost per unit. While these indicators are important for assessing scale and financial feasibility, they fail to capture the long-term performance of housing environments. As a result, projects that minimize upfront costs may be favored, even if they impose higher operational costs over time.

Finally, there is a lack of mechanisms to support incremental and adaptive development. Formal housing schemes are often designed as complete, finished products, leaving little room for expansion or modification. This is misaligned with the realities of many households, which rely on gradual investment and adaptation to meet changing needs.

13.2 TOWARD A SYSTEM-BASED PLANNING FRAMEWORK

Addressing these limitations requires a shift from plot-based regulation to a system-based planning framework. In such a framework, the settlement not the individual plot becomes the primary unit of design and evaluation. This shift entails rethinking how land is structured, how infrastructure is integrated, and how performance is measured.

At the level of spatial planning, this would involve the adoption of cluster-based development models. Instead of prescribing uniform plot sizes and rigid setbacks, planning guidelines could define parameters for the organization of housing clusters, shared spaces, and pedestrian networks. This would allow for greater flexibility in layout while ensuring that key relationships such as proximity, visibility, and access are maintained.

Environmental systems must also be brought into the core of the planning process. Rather than treating water management, vegetation, and climate responsiveness as secondary considerations, they should be used as primary structuring elements. This could be achieved through requirements for integrated blue-green infrastructure, including surface-based water management systems, tree cover, and shaded circulation networks.

In parallel, infrastructure planning should move toward a more decentralized and integrated model. Policies can encourage or mandate the incorporation of localized systems for water reuse, stormwater management, and energy efficiency. By aligning these systems with spatial design, it becomes possible to reduce dependency on centralized infrastructure while improving environmental performance.

13.3 REDEFINING METRICS OF AFFORDABILITY

A critical component of policy reform is the redefinition of how affordability is measured. As long as housing is evaluated primarily in terms of construction cost, there will be limited incentive to invest in systems that reduce long-term expenditure.

The ecological model of affordability suggests a shift toward lifecycle-based metrics, which account for the total cost of inhabitation over time. These metrics could include:

- Energy demand per household, reflecting the effectiveness of passive design strategies
- Water efficiency, including the extent of reuse and local management
- Mobility costs, measured through proximity to essential services and reliance on transport
- Access to shared infrastructure, such as communal spaces and environmental systems

Incorporating such indicators into policy frameworks would enable a more comprehensive evaluation of housing performance. It would also create incentives for developers and designers to prioritize long-term efficiency over short-term cost reduction.

13.4 ENABLING INCREMENTAL AND ADAPTIVE HOUSING

Given the economic realities of many households in Pakistan, policy frameworks must also support incremental modes of development. This requires moving away from the expectation of complete, finished housing at the point of delivery and toward models that allow for gradual expansion.

Regulatory adjustments could include:

- Flexible building codes that permit phased construction
- Guidelines for structural systems that accommodate future additions
- Provisions for mixed-use and home-based economic activities

Such measures would align formal housing provision with existing informal practices, bridging the gap between planned and lived realities. Importantly, they would also enhance economic resilience by enabling households to adapt their homes in response to changing circumstances.

13.5 INSTITUTIONAL AND GOVERNANCE IMPLICATIONS

The transition to a system-based model of housing also has implications for governance and institutional coordination. Currently, responsibilities for land use planning, infrastructure provision, and environmental management are often distributed across multiple agencies, with limited integration.

Implementing an ecological model of affordability would require more interdisciplinary and cross-sectoral coordination, bringing together planners, engineers, environmental specialists, and designers within a unified framework. This may involve the creation of new institutional mechanisms or the restructuring of existing ones to facilitate integrated decision-making.

Public agencies, particularly those involved in large-scale housing initiatives such as the Pakistan Affordable Housing Program (PAHP), are uniquely positioned to pilot such approaches. By incorporating system-based planning principles into publicly funded projects, they can establish precedents that inform broader practice.

13.6 FROM PROTOTYPE TO POLICY

The design-research project presented in this paper illustrates the spatial and environmental potential of an ecological model of affordability, but its broader significance lies in its capacity to inform policy. As a prototype, it demonstrates that alternative configurations are not only conceptually viable but spatially and technically achievable.

The challenge, therefore, is not one of invention but of translation, how to translate design insights into regulatory frameworks, financial models, and institutional practices. This requires a shift in perspective, where housing is no longer seen as a commodity to be delivered but as a system to be cultivated and maintained.

13.7 TOWARD A NEW HOUSING PARADIGM

Ultimately, the policy implications of this research point toward the need for a new housing paradigm, one that recognizes the interdependence of environmental, social, and economic systems. Such a paradigm would move beyond the delivery of units toward the design of settlements that are capable of sustaining life over time.

This does not imply the abandonment of existing frameworks but their transformation. Plot-based systems, zoning regulations, and infrastructural standards can be reinterpreted to support more integrated approaches. The goal is not to replace one model with another in absolute terms, but to expand the range of possibilities available within the planning system.

By embedding ecological thinking into the core of housing policy, it becomes possible to address affordability not as a narrow financial problem, but as a multidimensional challenge that encompasses climate, infrastructure, and social life. In doing so, housing can be repositioned as a critical site of intervention in the pursuit of more sustainable and equitable urban futures.



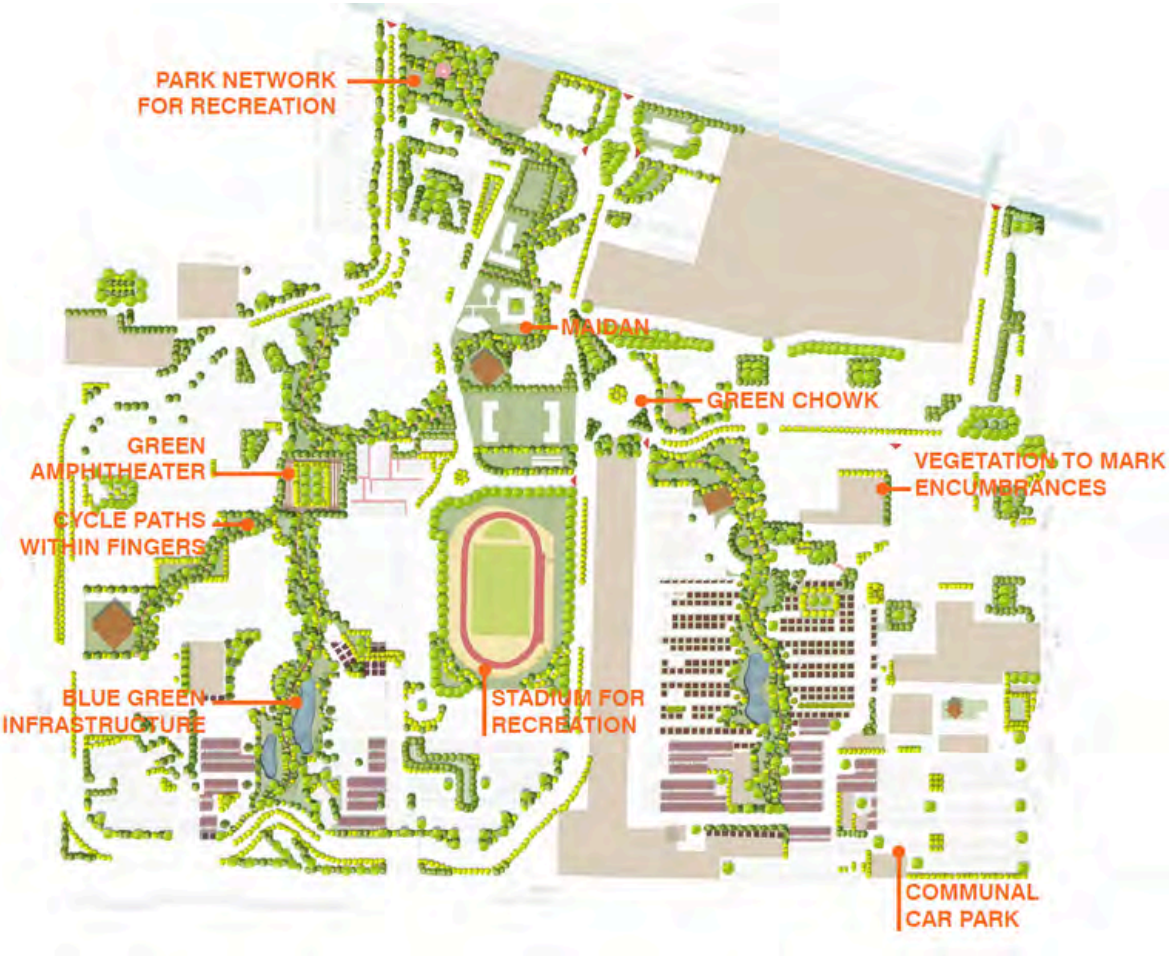
1. *Proposed Housing Typologies*



2. *Maidan Sketch*



3. Mohallah Sketch



4. Green Fingers



5. Proposed Site Plan

14. CONCLUSION

This paper has argued that the limitations of affordable housing in Pakistan are not solely the result of financial constraints or technical inefficiencies, but of a more fundamental issue: the persistent conceptualization of housing as a discrete, cost-minimized product. Rooted in subdivision planning models and reinforced by institutional frameworks, this approach isolates the dwelling unit from the environmental, infrastructural, and social systems that sustain it. In doing so, it produces settlements that may be economical to construct but are often costly to inhabit, both materially and socially.

By reframing housing as an integrated settlement system, the research proposes an alternative understanding of affordability, one that is grounded not in initial cost alone, but in the long-term performance of the environment in which housing is embedded. This ecological model of affordability shifts attention from objects to relationships: between built form and climate, between infrastructure and everyday use, and between spatial organization and social life. Affordability, in this sense, emerges not from minimizing inputs but from optimizing relationships between spatial form and resource flows, aligning with broader understandings of urban environments as metabolic systems (Kennedy, Cuddihy, and Engel-Yan 2007).

The design-research project presented in this paper operates as a spatial test of this framework. Through its emphasis on cluster-based organization, blue-green infrastructure, and incremental housing, it demonstrates how ecological systems and social structures can be integrated into the planning of low-rise, high-density settlements. The project does not claim to resolve the complexities of housing provision, but rather to illustrate the potential of a different approach, one in which environmental performance, social cohesion, and economic adaptability are treated as interdependent components of affordability.

Importantly, the implications of this research extend beyond the scale of the individual project. They point toward the need for a broader shift in planning and policy frameworks. As long as housing delivery remains tied to plot-based zoning, fragmented infrastructure provision, and output-driven metrics, the systemic conditions that undermine affordability will persist. Addressing these challenges requires the adoption of performance-based approaches that prioritize lifecycle costs, environmental integration, and the quality of shared space. It also requires a reorientation of institutional practices toward the design of settlements as cohesive systems rather than collections of units.

At a disciplinary level, this work contributes to an emerging discourse that positions housing as a form of ecological infrastructure. In this view, housing is not simply a container for living, but a medium through which relationships between people, resources, and environment are organized and sustained. This perspective expands the role of architectural and urban design, moving it beyond the production of form toward the orchestration of systems that support life over time.

In the context of rapidly urbanizing regions such as Pakistan, where climatic pressures, resource constraints, and social inequalities are increasingly intertwined, such a shift is both necessary and urgent. The challenge is not only to build more housing, but to build differently, to conceive of settlements that are capable of adapting, sustaining, and supporting the diverse realities of their inhabitants.

Ultimately, the transition from plot to system is not merely a technical adjustment but a conceptual reorientation. It requires rethinking the very basis on which housing is defined, designed, and evaluated. By situating affordability within an ecological and relational framework, this research offers a pathway toward more resilient, equitable, and inhabitable urban futures.

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PANEL 2

BEYOND PILOT PROJECTS: RETHINKING INNOVATION IN SCALABLE HOUSING SYSTEMS IN PAKISTAN

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2.Igor Malgrati, Senior Independent Consultant, Essential Services
3.Founder, Ajam and Ajam Associates
4.PhD, Senior Specialist GIS, Urban Unit

The second panel discussion focused on the relationship between housing innovation, technological systems, institutional reform, and scalability within the Pakistani context. Moderated by Amtul Mateen Ayesha, the discussion explored why housing technologies and innovative construction systems continue to struggle in Pakistan despite the availability of technical knowledge, digital tools, and emerging models of sustainable development. Rather than treating innovation as purely a technical challenge, the panel repeatedly returned to deeper questions of governance, institutional capacity, data systems, social performance, and resilience.

Amtul Mateen Ayesha opened the session by framing housing innovation not simply as a matter of introducing new technologies, but as a broader question about systems, governance, and scalability. She posed a central question that shaped the entire discussion: if housing technologies already exist, why have they failed to scale in Pakistan? Are the primary barriers technical, economic, or institutional? She further questioned whether innovation could succeed at all without simultaneously reforming procurement systems, land governance, and regulatory structures. By situating the discussion around the movement from isolated pilot projects toward scalable housing systems, she established a framework that connected technological innovation to larger institutional and political realities.

The first major discussion revolved around identifying the most significant barriers preventing the scaling of housing innovation in Pakistan. Invited to reflect on this issue from a geospatial and planning perspective, Dr. Urooj Saeed argued that the primary obstacle is not the absence of technology or expertise, but the lack of institutional transformation. She emphasized that Pakistan already possesses substantial amounts of geospatial data, GIS expertise, spatial analytics, and technological tools capable of supporting informed urban planning and housing decisions. According to her, thousands of analytical models, algorithms, and digital systems are available, and specialists capable of utilizing these systems already exist within institutions and professional networks. However, despite this technological capacity, institutions often remain reluctant or unequipped to integrate data-driven decision-making into governance structures and planning processes.

Her contribution shifted the discussion away from the idea that innovation fails because of technological limitations. Instead, she argued that the core issue lies in implementation cultures and institutional resistance to change. In her view, data itself is not transformative unless institutions are willing to trust, utilize, and operationalize it in decision-making processes. She suggested that future progress in housing systems will depend less on developing new technologies and more on changing governance structures so that digital intelligence, spatial analytics, and evidence-based planning can meaningfully shape policy and implementation on the ground.

Sikandar Ajam approached the same question from the perspective of architectural performance, affordability, and social sustainability. He challenged the dominant way housing affordability is currently measured within institutions and government systems. According to him, housing discussions in Pakistan often focus too narrowly on the immediate cost of constructing individual housing units rather than considering the long-term performance of those units and the broader environments in which they exist. He argued that governments and authorities frequently evaluate success through numerical indicators such as the number of units delivered or the lowest possible construction cost. However, these metrics fail to account for what he described as the "true costs" of housing, including long-term energy consumption, mobility burdens, environmental inefficiencies, maintenance costs, and social impacts experienced by residents after occupation.

He argued that reducing initial construction costs through short-term strategies can often create much larger

burdens for residents in the future. For example, housing projects may appear affordable during delivery but later. become financially and socially expensive because of poor thermal performance, inefficient infrastructure, inadequate mobility systems, or weak social integration. In his view, housing innovation should therefore shift away from simply minimizing unit costs and instead focus on improving the overall performance of housing systems and communities. He proposed thinking of housing not as isolated structures but as integrated systems shaped by resource flows, environmental conditions, spatial standards, and community relationships. According to him, institutions should be willing to invest more resources at the beginning if it reduces long-term burdens on residents and improves the social and environmental performance of housing systems over time.

The discussion then shifted toward lessons that could be learned from humanitarian and crisis-affected contexts. Amtul Mateen Ayesha invited Igor to reflect on how experiences from fragile environments and emergency housing systems might inform more sustainable housing strategies. Responding to this, Igor emphasized that contemporary urban development can no longer assume stability as a permanent condition. He argued that crises—whether environmental, economic, or health-related—are increasingly becoming normal components of urban life. Referring to the COVID-19 pandemic as an example, he explained that unexpected crises can rapidly transform into housing crises, exposing vulnerabilities within urban systems that previously appeared stable.

From this perspective, he argued that one of the most important lessons from humanitarian contexts is the need to build resilient and adaptable housing systems capable of enduring future shocks. Housing, in his view, should not simply provide shelter but should prepare communities to withstand uncertainty and periods of crisis. He emphasized the importance of integrating resilience not only socially and institutionally but also financially, through mechanisms such as insurance systems and emergency preparedness structures that can support communities during difficult times.

Another major point he emphasized was that housing cannot exist independently from broader social systems. Housing projects, according to him, must always be accompanied by access to water, sanitation, energy systems, employment opportunities, social security, and community cohesion. He repeatedly argued that housing should be understood as an opportunity to build communities rather than merely deliver physical structures. This perspective shifted the conversation away from purely technical models of housing toward more human-centred and socially integrated understandings of urban development.

He also reflected on the importance of maintaining a human focus within technological and technical discussions. Although contemporary planning frequently speaks about human-centred design, he suggested that this human dimension is often lost once discussions become overly technical or bureaucratic. For him, sustainable housing systems require listening to communities, understanding local cultures, involving residents in decision-making processes, and developing trust between institutions and users. Sustainability, according to him, does not emerge solely from technical solutions but from systems in which stakeholders possess both the willingness and the capacity to sustain them over time. He stressed that sustainable housing depends not only on physical design but also on awareness, knowledge, resources, maintenance capacities, and social ownership.

Expanding further on the relationship between technology and implementation, Amtul Mateen Ayesha directed the discussion toward prefabrication and industrialized building systems, asking why such systems have failed to become widespread in Pakistan. Responding to this, Sikandar Ajam argued that industrialized construction and prefabrication can be valuable if they improve construction quality and reduce delivery times. However, he also highlighted important tensions within the Pakistani context, particularly regarding labour systems and local economies. Traditional construction industries in Pakistan employ large numbers of workers not only on building sites but also across related manufacturing and material industries. As a result, highly industrialized construction systems may reduce labour demand and alter the structure of employment within the construction sector.

At the same time, he acknowledged that prefabrication could improve thermal performance, affordability, and construction efficiency if implemented appropriately. Rather than importing entirely factory-based industrial systems, he advocated for localized forms of prefabrication that operate closer to construction sites and utilize local technologies and materials. He discussed the possibility of site-based prefabrication systems using locally appropriate materials such as mud bricks, larger structural panels, and localized roofing systems. In his view, large-scale housing projects containing hundreds of units could potentially serve as testing grounds for industrialized systems that strengthen local economies while simultaneously improving housing performance and

delivery efficiency. The discussion then moved back toward data systems, geospatial intelligence, and predictive planning. Amtul Mateen Ayesha asked Dr. Urooj Saeed how AI and spatial analytics could realistically contribute to housing governance, land management, and future planning in Pakistan. In response, Dr. Urooj emphasized that housing is fundamentally a locational issue. Every aspect of housing development—from land values and infrastructure access to flood vulnerability and transportation systems—is deeply connected to geography and spatial conditions. She explained that geospatial intelligence allows planners to analyze not only current conditions but also future urban growth patterns, environmental risks, and land suitability.

She described recent work undertaken in Punjab, including the development of a Housing Management Information System in collaboration with PHATA, the Housing Department, and the World Bank. Through this system, multiple layers of spatial information were integrated to analyze urban expansion, rural growth, land valuation, infrastructure conditions, soil quality, and disaster-prone areas. She explained that spatial analytics and machine learning algorithms can forecast future patterns of urban growth, identify likely expansion corridors, and help governments make more informed decisions regarding future housing developments.

At the same time, she repeatedly stressed that the effectiveness of AI systems depends entirely on the quality of the input data being used. Referring to the GIS principle of "garbage in, garbage out," she argued that predictive systems are only as reliable as the data feeding them. For her, technological innovation therefore requires not only sophisticated analytical systems but also accurate, transparent, and continuously updated data infrastructures.

As the session approached its conclusion, the conversation increasingly framed housing innovation as a multidimensional challenge that cannot be solved through technology alone. Across the discussion, all panelists repeatedly emphasized that technical systems must be accompanied by institutional reform, community engagement, environmental resilience, accurate data infrastructures, and long-term thinking. Housing innovation was ultimately presented not as a singular technological breakthrough but as the creation of integrated systems capable of balancing affordability, social performance, resilience, governance, and human dignity. Rather than focusing exclusively on construction technologies themselves, the discussion highlighted the broader political, institutional, and social transformations required if scalable and sustainable housing systems are to emerge within Pakistan's rapidly changing urban landscape.



SESSION 3:

THEME:

CLIMATE RESPONSIVE HOUSING AND RESILIENT BUILT FORMS

SESSION 3 :

THEME: CLIMATE RESPONSIVE HOUSING AND RESILIENT BUILT FORMS

KEYNOTE :

CLIMATE RESILIENT DEVELOPMENT: LESSONS, CHALLENGES, AND OPPORTUNITIES FROM PAKISTAN

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Climate change and disaster risk are no longer distant environmental concerns; they are increasingly shaping development trajectories, urban systems, livelihoods, and housing futures across Pakistan. The floods of 2022, followed by further extreme weather events in subsequent years, demonstrated the scale of vulnerability embedded within the country's planning and development systems. These events revealed not only the environmental risks associated with climate change, but also the structural weaknesses in governance, infrastructure, land management, and urbanization patterns that continue to amplify disaster impacts. At the same time, they also highlighted opportunities for more resilient forms of development grounded in adaptation, risk reduction, and community resilience.

To understand climate resilient development, it is first important to understand the relationship between disasters and development itself. In an ideal developmental trajectory, indicators such as GDP, economic growth, infrastructure provision, and social wellbeing would continue to improve steadily over time. However, in reality, disasters repeatedly interrupt and erode these development gains. Each flood, heatwave, drought, or climate-related event creates economic losses, damages infrastructure, disrupts livelihoods, and pushes vulnerable populations deeper into poverty. Recovery processes are often slow and uneven, creating prolonged periods of stagnation in which communities struggle to rebuild while simultaneously remaining exposed to future risks. Before full recovery can occur, another climate event frequently emerges, trapping populations within recurring cycles of vulnerability and loss.

Resilience, therefore, becomes fundamentally linked to the capacity of societies and systems to recover quickly, reduce future damages, and adapt development processes in ways that minimize exposure and vulnerability. Climate resilient development seeks to reduce the magnitude of disruption caused by environmental hazards while strengthening the ability of communities and infrastructure systems to withstand and recover from shocks. In this context, resilience is not simply about post-disaster recovery; it is about integrating risk reduction and climate adaptation directly into planning, housing, infrastructure, and governance systems before disasters occur.

Climate change is already intensifying hydrological and environmental risks across Pakistan. Research indicates that short-duration precipitation events—particularly rainfall events occurring within periods of less than twenty-four hours—are projected to increase significantly in intensity. Rising temperatures are simultaneously accelerating glacial melt, altering water storage systems within the Indus River Basin, and increasing the likelihood of flash flooding. These climatic transformations are not isolated environmental concerns; they have cascading impacts on food systems, biodiversity, water security, and urban infrastructure. As natural systems become increasingly unstable, urban settlements and vulnerable communities become progressively exposed to environmental hazards that existing planning systems are often unable to manage effectively.

The floods of 2022 represented one of the clearest manifestations of these intersecting vulnerabilities. The crisis emerged following an unusually prolonged heatwave that rapidly transitioned from winter conditions into extreme summer temperatures.

Although some warning signs were visible, the scale of the monsoon event and the resulting flooding exceeded expectations. In Sindh, low-pressure systems combined with prolonged rainfall to create catastrophic flooding across large territories. Areas that were never intended to function as lakes became submerged for extended periods, displacing communities and devastating agricultural systems. Flood mapping across Pakistan revealed both flash flooding in northern and mountainous regions as well as widespread fluvial flooding in Sindh, where water accumulated and failed to drain effectively.

The consequences for affected communities were severe. In many flood-affected areas, particularly within rural Sindh, traditional kacha housing structures were completely destroyed while only a limited number of more durable pakka structures survived. Agricultural systems were devastated, infrastructure collapsed, and prolonged inundation displaced communities for extended periods of time. These experiences revealed the degree to which housing vulnerability is deeply connected to environmental exposure, poverty, and infrastructural weakness.

At the same time, recent urban flooding events demonstrated that vulnerability is not confined to rural or low-income regions alone. In Lahore, for example, flooding in developments such as Park View illustrated the consequences of constructing urban settlements directly within floodplains and ecologically sensitive areas. Similarly, failures in bridges, drainage systems, and urban infrastructure across different regions revealed weaknesses in both planning and maintenance systems. In many cases, infrastructure failed not because hazards were unprecedented, but because systems had not been designed, maintained, or governed adequately to manage foreseeable environmental pressures.

Within disaster risk research, such events are increasingly understood not as purely "natural disasters" but as failures of development systems. Floods become catastrophic not only because of rainfall intensity, but because of exposure, vulnerability, land-use decisions, inadequate infrastructure, and weak planning systems. Vulnerability is socially and institutionally produced. Encroachments upon waterways, unregulated urban expansion, deforestation, paving of green spaces, and environmentally disconnected planning decisions collectively transform environmental hazards into large-scale disasters.

Urbanization patterns across Pakistan provide particularly important evidence of these systemic failures. In cities such as Karachi and Islamabad, recurring urban flooding reflects decades of land-use change, encroachment upon drainage channels, and the paving over of natural ecological systems. Satellite imagery comparing urban expansion between 2000 and 2025 demonstrates extensive urban sprawl accompanied by the destruction of forests, agricultural land, and open green spaces. Streams and natural drainage channels have been narrowed, straightened, or completely erased in order to accommodate housing developments, commercial centres, roads, and gated communities.

These changes have significantly increased flood vulnerability within urban areas. In Islamabad's E-11 sector, for example, waterways and natural streams have been obstructed or built over, causing streets to function like rivers during heavy rainfall events. Similar patterns are visible across multiple urban centres where ecological systems have been sacrificed for short-term development gains without consideration for long-term environmental consequences. Such examples demonstrate how urban flooding is deeply connected to planning choices and development priorities rather than climate hazards alone.

At the same time, there are also important examples demonstrating how relatively simple interventions can significantly improve resilience. In some urban areas, functional stormwater drainage systems have substantially reduced flooding impacts during rainfall events. However, even these systems require integration with solid waste management because blocked drains and poorly maintained infrastructure can quickly undermine their effectiveness. Climate resilience therefore depends not only on engineering systems but on integrated governance approaches connecting drainage, waste management, planning, and maintenance systems together.

Perhaps one of the most significant lessons emerging from Pakistan's flood experiences comes from local and indigenous forms of adaptation. In flood-prone rural settlements located between the Chenab and Jhelum rivers, communities have historically developed ways of living with seasonal flooding rather than attempting to eliminate it entirely. Housing structures are elevated, livestock evacuation strategies are embedded within local practices, and communities understand the rhythms and behaviour of rivers through long-term lived experience. These adaptive practices demonstrate forms of resilience rooted not in high technology or expensive infrastructure, but in local knowledge, environmental understanding, and collective adaptation.

Such examples suggest that resilience planning should not rely solely on top-down technical solutions. Instead, there is a need to engage communities directly, recognize local knowledge systems, and move toward more participatory forms of adaptation planning. Community empowerment becomes essential within this process because local populations often possess valuable knowledge about environmental behaviour, vulnerability patterns, and adaptive practices that formal planning systems frequently overlook. Resilience therefore depends not only on technical expertise but also on collaborative governance and meaningful participation.

The integration of climate adaptation within development planning does not necessarily require highly expensive or technologically complex interventions. Many forms of resilience can be achieved through relatively basic measures integrated within planning and design systems. These include aligning reconstruction efforts with flood-risk zoning, protecting ecological corridors, restoring natural drainage systems, integrating nature-based solutions, and embedding disaster risk reduction within housing and infrastructure planning. Ecosystem-based adaptation strategies—including wetland restoration, green infrastructure, permeable landscapes, and ecological buffers—can significantly reduce vulnerability while simultaneously supporting environmental sustainability.

At the same time, scientific and institutional capacity remains critically important. Improved climate measurements, forecasting systems, modelling technologies, and early warning systems play an essential role in reducing disaster impacts and saving lives. Investments in data systems, climate science, and environmental monitoring therefore produce multiplier effects across governance, planning, and emergency response systems. Accurate measurements and predictive capacities strengthen decision-making processes and improve the ability of institutions to prepare for future risks.

Pakistan has already begun taking steps toward more resilient housing and community systems through initiatives led by organizations such as PHATA, Rescue 1122, and humanitarian organizations working on community-level resilience building. Efforts to promote resilient housing typologies, strengthen local preparedness systems, and integrate climate considerations within housing development represent important beginnings. However, these initiatives must now be expanded systematically and embedded more deeply within broader planning and development frameworks.

Ultimately, climate resilient development requires a fundamental shift in how development itself is understood. Housing, infrastructure, urbanization, ecological systems, and disaster risk cannot be addressed separately because they are structurally interconnected. The costs of resilience interventions may initially appear significant when viewed only through the lens of construction or infrastructure expenditure. However, when broader social benefits are considered—including poverty reduction, livelihood protection, environmental sustainability, reduced disaster losses, and long-term economic stability—the value of resilient development becomes far more substantial. Climate resilience therefore should not be viewed as an additional burden upon development, but as a necessary condition for sustainable and equitable futures within increasingly uncertain environmental conditions.

PAPER 1:

Toward a Morphology of Resilience: Integrating Ethics, Ecology, and the Green Imperative - for Climate-Responsive Urbanism and Disaster Mitigation in Pakistan

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ABSTRACT

The unique biosphere and topography of Pakistan, a "glacial jewel" of the terra firma, now faces its most daunting challenge in the form of climate change and erratically altering landscapes. This research addresses the striking unpreparedness within established urban centers against an "unrelenting revolt" of environmental forces that lacks historical precedent. The aim of this paper is to theorize and propose a "Morphology of Resilience"—a multidisciplinary framework that merges the science of building with the ethics of conservation. The methodology employs a dual-rooted approach, combining high-level theoretical research in material computation with twenty years of ground-level field practice in disaster-prone zones. By analyzing longitudinal data from the 2005 earthquake to the 2022/2024 floods, the study evaluates the performance of "scalable resilience prototypes." Key findings indicate that traditional urbanization models are obsolete; however, through "Material Thinking"—optimizing vernacular systems like bamboo and modular tectonics—communities can achieve thermal efficiency and structural safety at a very affordable cost. The paper contributes to knowledge by moving architectural discourse away from predetermined aesthetics toward performance-driven, ethical design that balances ecological and economic imperatives at both micro and macro scales.

The sheer magnitude of this change vis-à-vis the striking unpreparedness of our cities is a recipe for disaster. It is of paramount significance for our country to adopt holistic disaster risk management and adopt/implement integrated policies and plans towards inclusion, resource optimization, mitigation and adaptation to climate change and build resilience to disasters.

KEYWORDS:

Climate Resilience, Morphology of Resilience, Material Thinking, Sustainable Urbanization, Sustainable Design, Climate-Resilient Pakistan, Disaster Preemptiveness, Disaster Relief, Disaster Reparation, Vernacular Tectonics.

INTRODUCTION:

In the current era of the Anthropocene, the "Green Imperative" has transitioned from a progressive architectural choice to a mandatory survival mandate for Pakistan [cite: 3]. This nation—a "glacial jewel" of unique biosphere and topography—now faces its most daunting challenge as its landscape undergoes an "unrelenting revolt" of climate forces [cite: 4]. From the high-altitude peaks of the north to the southern coastal plains, the country is witnessing an erratic alteration of its terra firma and a violent deformation of its socio-economic fabric [cite: 5].

The problem space is defined by a striking unpreparedness within established urban centers [cite: 6]. As climate forces intensify, traditional urbanization models have proven entirely inadequate [cite: 7]. "Climate Change and its unrelenting revolt against the established order of urbanization, is a force that has no remedial precedent or historic paradigm and an inimical force that knows no boundaries, has no predicted limit or quantifiable scale of destruction" [cite: 9].

he shift toward a "Morphology of Resilience" is the only viable path for socio-economic survival [cite: 10]. This approach transforms architectural practice from a pursuit of aesthetics into a rigorous discipline of disaster mitigation [cite: 11]. By integrating ethics, economics, and ecology, we move toward accountability to conserve an ecological and economic balance [cite: 12].

2. LITERATURE REVIEW:

Karawaanserai Studios operates as a multidisciplinary pioneer, bridging the gap between high-level theoretical research and ground-level implementation [cite: 15]. The studio's work is underpinned by the "Green Imperative," established through decades of research and development in Disaster prone and Conflict Zones by the Principal Founder Ar. Farooq Usman Shahid and his multi-disciplinary team of experts and Ar. Zeeshan Zaheer and his intensive studio discourse and programs. [cite: 20, 21].

Since 2005 Earth-quake disaster that shook the very core of our nation and questioned the inadequate measures in governance and development; left an indelible mark on the young mind and heart of Ar. Farooq Usman Shahid, as he worked with various Foundations and Departments for the Rehabilitation and Reconstruction of the affected victims and areas. Since then, both in academia and in practice, he has been advocating the need to develop a 'Morphology of Resilience' that can scientifically be applied on micro and macro level development and structures. Leading eventually to open a Multi-disciplinary Architecture Design Firm, 'KARAWAANSERAI STUDIOS'.

2.1 MATERIAL THINKING AND PERFORMANCE-DRIVEN DESIGN

Central to this framework is the reassociation of "material thinking" with architectural practice to create low-carbon, climate-resilient communities [cite: 23]. This methodology moves architecture away from "predetermined shapes" and toward "performance-driven design" [cite: 38]. Rather than imposing a fixed aesthetic, the design emerges from how materials respond to environmental forces, including seismic loads, high-velocity winds, and extreme flooding [cite: 39, 40].

'Karawaanserai Studios', is one of the pioneering Architecture Design, Research and Construction Firms that has its roots, ethos and practice etched in Sustainable Thought and Action. Our design and building practice was established on foundations anchored in the Green Imperative. We profoundly advocate the need to consciously theorize and exercise accountability to conserve an ethical, ecological and economic balance, both in design and its development; and in doing so to create a Climate-Resilient Community.

2.2 PEDAGOGICAL EVOLUTION

Shifting the future of the built environment requires a pedagogical evolution, moving from "representation" to "process-driven design" [cite: 61, 62]. This includes investigating material behavior such as bending, folding, and interlocking, and training students in logic-driven design where form evolves through making [cite: 68, 71].

A unique expertise being tailored for almost 20 years, Karawaanserai Studios takes honour in diligently and arduously working for the ultimate challenge of creating Climate-Resilient Innovations and Sustainable forms of development. A critical urgency for Pakistan's public & private sector alike, to actively pursue a policy framework that aims to mitigate the effects of Climate Change and guides in cultivating indigenous methods and designs for sustainable resilience.

3. METHODOLOGY

The "Morphology of Resilience" is defined as a discipline that merges the science of building with the ethics of conservation [cite: 32]. The research design is "dual-rooted," anchored in both academic rigor and field practice [cite: 16]. Our academia initiations cater to the deconstruction and the exploration of Morphological Forms, whereas, the field work and practice tests these findings and ideas on a life scale and in very remote and deprived communites and sensitive climatic zones.

3.1 STRATEGIC FRAMEWORK

The morphology operates across a comprehensive architectural scale [cite: 34]:

- Micro-level: Optimizing individual housing structures with Resilient Morphology for safety, durability, and thermal efficiency [cite: 35].
- Macro-level: Strategic regional and community planning that addresses inclusive urbanization and ecological links [cite: 36].
- Analytical Mandate: The use of "Material Computation" and "Material Tectonics" to optimize vernacular systems [cite: 37].

Karawaanserai Studios, has been working on the agenda of creating a Climate-Resilient Pakistan and has accumulated years of research, practice and experience in optimizing vernacular systems to achieve low-carbon innovative ecological solutions.

4. ANALYSIS / FINDINGS

The theoretical morphology of resilience finds its justification in the quantifiable wreckage of the last two decades [cite: 42]. The following table summarizes the scale of environmental revolt that has rendered traditional urbanization obsolete [cite: 43, 44]:

Event	Impact & Scale	Notable Locations
2005 Northern Pakistan Earthquake	Total destruction of traditional structures; massive displacement.	AJK (Koutch e Syeda); Northern Areas.
2022/2024 Flooding	1000% excess rainfall in 24 hours (Punjab); 15 million people affected.	Punjab and Sindh (Kachho belt).
Infrastructure Loss	Over 2 million houses damaged in Sindh alone (as of Aug 2024).	Sindh Province; Roshi.

4.1 SCALABLE PROTOTYPES

The following interventions utilize "Material Thinking" to transform indigenous materials into sophisticated structural systems [cite: 48, 49]:

- Flood Resilient Model Bamboo House (Sindh): Optimizes vernacular bamboo systems with elevated platforms to create low-carbon, flood-safe habitats [cite: 51, 52].
- Resilient Roots (Nepal): A modular system utilizing stringer columns and trussed roofing for seismic and wind resistance [cite: 53, 54].
- Olive Branch (Palestine): Utilizes "half cut pallet" modules and straw insulation for thermal efficiency [cite: 55, 56].
- KVO/Himalayan Wildlife: Adaptive disaster-resilient policies for sensitive eco-tourist zones [cite: 57, 58].
- Eco-Village Master Planning and Development in AJK: Climate and Flood Resilient Master planning and Development in Climate Sensitive and Conflict zones of Azad Jammu and Kashmir.

5. DISCUSSION

The findings indicate that the magnitude of recent environmental events proves established orders of urbanization are no longer functional [cite: 45]. This necessitates a transition to "scalable resilience prototypes" [cite: 46]. The

discussion focuses on how research output, such as integrating subterranean bunker infrastructure and assessing high-rise building density on CFC emissions, informs the future of urban survival [cite: 63, 65]. Critical interpretation suggests that strengthening national planning for safe, climate-smart housing is no longer a choice but a matter of national survival [cite: 75, 76].

Climate Change and its unrelenting revolt against the established order of urbanization, is a force that has no remedial precedent or historic paradigm and an inimical force that knows no boundaries, has no predicted limit or quantifiable scale of destruction.

6. CONCLUSION

The evidence of the past two decades serves as a clear signal for the Morphology of Resilience to be adopted as national policy [cite: 74]. The ultimate mandate is one of accountability—conserving the ecological and economic balance of Pakistan through ethical design and holistic disaster risk management [cite: 77]. All thinking, planning, and implementation must now be ethical, economical, and ecological [cite: 78].

By strengthening national and regional development planning, enhancing inclusive and sustainable urbanization, ensuring access for all to adequate, safe and affordable housing and basic services, developing regional socio-economic and environmental links between urban, peri-urban and rural areas; we can ensure that across the landscape disaster mitigation and resilience can be truly achieved. All thinking, planning and implementation should now be ethical, economical and ecological. We profoundly advocate the need to consciously theorize and exercise accountability to conserve an ecological and economic balance, both in design and its implementation.

To do so, it is important for us to develop a 'Morphology of Resilience'; a discipline, a study and a guide to help assist and teach the communities and practitioners the actual science behind creating Resilience both in micro-level individual housing structures and macro-level regional and community planning.

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PAPER 2:

Affordable Housing and the City: Development of a Climate-Responsive Smart Housing Model for a Sustainable Built Environment

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ABSTRACT

Rapid urbanization in Lahore has intensified the demand for affordable housingwithin a sustainable smart city framework. This research proposes a climateresponsiveAffordable Smart Housing Model (ASHM) that integrates architectural strategies, modular construction, and digitally enabled infrastructure to address spatial, environmental, and economic constraints. The model combines optimized systems. Designed around principles of compact urban form and incremental growth, it emphasizes low-embodied-energy materials and scalable development mechanisms. Aligned with Sustainable Cities and Communities, the study demonstrates that integrating architectural performance with smart urban systems can significantly reduce energy demand and lifecycle costs. The proposed framework and model offer a replicable prototype for advancing affordable, resilient, and resource-efficient housing in rapidly urbanizing contexts.

INTRODUCTION:

Urbanization is fundamentally reshaping spatial, environmental, and socio-economic conditions in cities across the Global South. With projections indicating that nearly 68% of the global population will reside in urban areas by 2050 [1], the pressure on urban housing systems is expected to intensify significantly. In Pakistan, the housing deficit has already surpassed 10 million units [2], reflecting a persistent gap between supply and demand. Lahore, as one of the country's fastest-growing metropolitan centers, exemplifies this challenge, where rapid population growth is accompanied by unregulated expansion and declining environmental quality.

The impacts of climate change further complicate this situation. Rising temperatures, intensified urban heat island effects, and recurring flooding events have made conventional housing increasingly uninhabitable during peak seasons [3, 4]. Buildings in hot climates are particularly energy-intensive, with cooling demands accounting for more than 60% of total energy consumption [9]. In low-income contexts, where access to reliable electricity is limited, this creates a cycle of discomfort, inefficiency, and financial burden.

Conventional housing approaches have largely focused on minimizing upfront construction costs, often neglecting long-term performance and environmental responsiveness. As a result, many housing developments fail to provide adequate thermal comfort, ventilation, or resilience to climatic stresses. This research challenges such approaches by proposing a holistic model that integrates urban design, architecture, and smart systems to create affordable yet sustainable housing environments.

2. PROBLEM STATEMENT:

The housing crisis in Lahore extends beyond the numerical shortage of units to encompassfundamental deficiencies in design quality and environmental performance. Informal settlementsand low-cost housing developments are frequently characterized by inadequateconstruction materials, poor spatial planning, and a lack of basic infrastructure [5, 6]. These shortcomings manifest in the form of extreme indoor temperatures, insufficient ventilation, and vulnerability to flooding. Urban heat island intensification has further exacerbated these issues. Over the past two decades, land surface temperatures in densely built areas have increased significantly, with some regions experiencing temperature rises of up to 2°C [14]. This phenomenon is largely attributed to the replacement of natural landscapes with heat-absorbing materials such as concrete and asphalt, combined with the absence of urban vegetation.

Additionally, inefficient urban morphology—marked by narrow streets, high plot coverage, and lack of shading—restricts airflow and traps heat within built environments. As a result, residents are compelled to rely on mechanical cooling systems, leading to increased energy consumption and financial strain. In many cases, energy shortages further limit access to such systems, leaving vulnerable populations exposed to extreme heat. These conditions highlight a critical disconnect between affordability and sustainability in current housing models. Addressing this gap requires a comprehensive approach that simultaneously considers environmental performance, economic feasibility, and social well-being.

3. METHODOLOGY:

This research adopts a mixed-method approach that integrates theoretical analysis with design-based exploration. The methodology is structured around four key components.

First, a comprehensive literature review was conducted to examine existing research on climate-responsive architecture, sustainable urban planning, and smart city systems. This review provided a theoretical foundation for identifying effective design strategies applicable to hot climates.

Second, a detailed climate analysis of Lahore was undertaken, focusing on temperature variations, solar radiation patterns, and prevailing wind directions. Understanding these climatic parameters was essential for developing context-specific design responses.

Third, case studies of existing housing developments were analyzed to identify common shortcomings and best practices. These case studies highlighted the limitations of conventional approaches and informed the development of an alternative framework. Finally, the Affordable Smart Housing Model (ASHM) was developed through an iterative design process. Performance outcomes were evaluated using established benchmarks from existing research, which indicate that passive design strategies can reduce cooling loads by up to 70% [12].

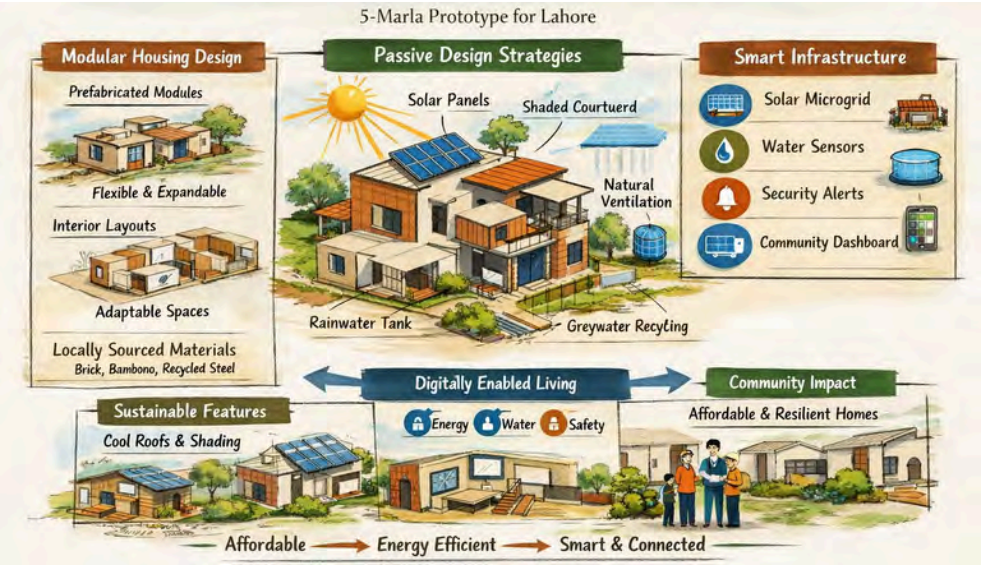


Figure 1: Climate responsive affordable smart housing model

4. URBAN AND ENVIRONMENTAL CHALLENGES

Lahore's urban condition is shaped by overlapping environmental and infrastructuralpressures that significantly influence housing performance and livability. These challenges are interconnected and must be addressed through integrated design strategies rather than isolated interventions.

4.1 URBAN HEAT ISLAND EFFECT:

The urban heat island (UHI) effect has intensified due to rapid urban expansion and the replacement of vegetated surfaces with concrete and asphalt. These materials absorb and retain heat, leading to elevated daytime and nighttime temperatures [17]. This continuous heat retention reduces the effectiveness of natural cooling cycles and significantly increases indoor discomfort, particularly in poorly ventilated housing units.

The impact of UHI is especially severe in low-income settlements where residents have limited access to cooling technologies. Roofs constructed from low-quality materials such as corrugated metal sheets absorb excessive solar radiation and transfer heat directly into indoor spaces. In dense urban districts, the lack of airflow between buildings further contributes to overheating. As nighttime temperatures remain high, buildings are unable to release accumulated heat, resulting in prolonged thermal discomfort.

Urban heat islands also increase energy consumption by intensifying the need for air conditioning and mechanical cooling systems. This creates additional strain on already fragile energy infrastructure while simultaneously increasing greenhouse gas emissions.

The relationship between urban morphology and thermal performance therefore becomes critical in determining long-term urban sustainability. Strategies such as reflective surfaces, shaded streets, green roofs, and vegetated courtyards can help mitigate these effects while improving outdoor comfort.

4.2 FLOODING AND DRAINAGE:

Monsoon flooding remains a persistent issue in Lahore, primarily due to inadequate drainage infrastructure and the encroachment of natural water channels [6]. The increase in impermeable surfaces prevents groundwater absorption, leading to rapid surface runoff. As a result, low-income housing is frequently exposed to water damage, structural deterioration, and health risks.

Rapid urbanization has significantly altered the city's natural hydrological systems.Wetlands and permeable open spaces that once absorbed rainwater have gradually been replaced by roads, parking areas, and concrete developments. During heavy rainfall events, drainage systems become overwhelmed, causing water to accumulate in streets and residential areas. Informal settlements located near drains and canals are particularly vulnerable because of poor infrastructure and inadequate waste management practices.

Flooding also has long-term socio-economic consequences. Water infiltration weakens building foundations, damages electrical systems, and increases maintenance costs for already vulnerable households. Stagnant water contributes to the spread of waterborne diseases and creates unhealthy living conditions. Integrating rainwater harvesting systems, permeable paving, bioswales, and decentralized drainage infrastructure into housing developments can improve resilience while reducing pressure on municipal systems.

4.3 ENERGY CONSTRAINTS

Pakistan's energy shortages further complicate housing performance. Limited access to reliable electricity restricts the use of mechanical cooling systems, particularly for low- income households [22]. This creates a dependency on passive strategies, highlighting the importance of designing buildings that minimize energy demand.

Frequent power outages during summer months significantly reduce indoor comfort levels, especially during heatwaves. In many cases, residents rely on inefficient backup systems such as diesel generators, which increase both operational costs and environmental pollution. Rising electricity tariffs also make air conditioning financially inaccessible for a large portion of the urban population.

The residential sector accounts for a considerable percentage of national electricity consumption, much of which is associated with cooling demand. Conventional housing typologies often ignore climatic responsiveness, resulting in buildings that trap heat and require continuous mechanical ventilation. Improving building orientation, insulation, Shading, and natural ventilation can substantially reduce dependence on active systems.

The integration of renewable energy technologies such as rooftop solar panels further enhances energy security and resilience.

4.4 LACK OF GREEN INFRASTRUCTURE:

Urban vegetation plays a critical role in regulating microclimates through shading and evapotranspiration. However, rapid urbanization has significantly reduced green cover in Lahore. Research indicates that urban greening can lower ambient temperatures and improve thermal comfort [15], making it a key component of sustainable housing design. The disappearance of parks, trees, and open landscapes has weakened the ecological balance of the city. Green infrastructure not only improves environmental quality but also contributes to psychological well-being and social cohesion. In densely populated neighborhoods, access to shaded communal spaces encourages outdoor activity, interaction, and healthier lifestyles.

Vegetation also contributes to air purification by reducing dust and absorbing pollutants generated by traffic and industrial activity. The incorporation of green corridors, community gardens, rooftop planting, and shaded courtyards within affordable housing developments can improve biodiversity and create more livable urban environments. These interventions are particularly valuable in compact urban settings where environmental quality is often compromised.

5 CLIMATE ANALYSIS

Lahore's composite climate is characterized by extreme heat, high solar radiation, and seasonal humidity variations. Peak summer temperatures frequently exceed 45°C, placing considerable stress on indoor environments. Solar exposure analysis reveals that east–west facades receive the highest heat gain due to low angle radiation, making orientation a critical design factor.

Prevailing wind patterns, particularly from the southwest during summer, present opportunities for passive cooling through cross-ventilation. By aligning building layouts and street networks with these wind directions, airflow can be significantly improved. These climatic conditions necessitate a design approach that minimizes heat gain while maximizing natural ventilation.

Humidity levels during the monsoon season further complicate thermal comfort conditions. High humidity reduces the effectiveness of perspiration-based cooling in the human body, increasing discomfort even when temperatures are moderate. Consequently, housing design must address both dry heat and humid conditions through adaptable environmental strategies.

Solar analysis demonstrates that roofs and exposed walls are major contributors toheat gain in residential bu ildings. In low-income settlements, poorly insulated roofs absorb substantial solar radiation throughout the day. Introducing reflective roof coatings, roof gardens, and ventilated roof assemblies can significantly reduce indoor temperatures. Similarly, recessed windows and shading devices can minimize direct solar penetration
while allowing daylight access. The climate analysis also highlights the importance of thermal mass in regulating indoor conditions. Materials such as brick and earth-based construction absorb heat slowly during the day and release it gradually at night, reducing temperature fluctuations. When combined with proper ventilation, thermal mass can improve comfort without increasing energy demand.

Seasonal wind patterns provide opportunities for passive cooling through courtyard planning and building orientation. Openings positioned along prevailing wind directions can facilitate cross ventilation, while stack ventilation strategies allow warm air to escape through higher openings. These principles form the basis of the environmental strategies incorporated into the ASHM framework.

6 PROPOSED AFFORDABLE SMART HOUSING MODEL (ASHM)

The ASHM integrates urban planning, architecture, and smart technologies into a unified framework aimed at enhancing environmental performance and affordability. The model is based on the understanding that housing should not be treated as an isolated building object but rather as part of a larger ecological and urban system. Therefore, the proposed framework combines environmental responsiveness with social inclusivity and economic feasibility.

The ASHM is designed to support incremental urban growth while maintaining flexibility for future adaptation. Instead of relying on expensive high-technology systems alone, the model prioritizes passive environmental strategies supported by selective smart technologies. This approach reduces operational costs while ensuring accessibility for lowincome populations.

6.1 URBAN DESIGN STRATEGY

The model employs a cluster-based layout that organizes housing around shared courtyards and green corridors. This configuration reduces exposed surfaces, enhances shading, and promotes airflow. The inclusion of green infrastructure not only mitigates heat but also improves social interaction and spatial quality [10]. The cluster arrangement creates semi-private communal spaces that encourage interaction between residents while maintaining security and privacy. Shared courtyards function as environmental buffers by reducing heat gain and supporting natural ventilation. These communal areas can also accommodate social activities, children's play areas, and urban agriculture initiatives.

Street orientation within the model is carefully designed to minimize solar exposure while maximizing airflow. Narrow shaded streets reduce direct heat gain and improve pedestrian comfort. Mixed-use planning further enhances accessibility by integrating small-scale commercial activities and community services within walking distance.

6.2 ARCHITECTURAL STRATEGY

Passive design principles are central to the architectural approach. Courtyards function as thermal regulators by facilitating air circulation and daylight penetration. Shading devices, optimized orientation, and thermal mass materials further reduce heat gain and enhance comfort [11].

The architectural strategy prioritizes human comfort through climate-responsive spatial planning. Open floor layouts improve airflow across interior spaces, while window placement is optimized to encourage cross ventilation. Deep overhangs and perforated screens reduce direct solar radiation while maintaining visual connectivity and daylight access.

Flexibility is another important component of the design strategy. Housing units are planned to allow incremental expansion according to family needs and financial capacity. This adaptability supports long-term affordability and prevents the need for unregulated informal extensions that often compromise environmental performance.

6.3 MATERIAL STRATEGY

The use of locally available materials such as brick supports both sustainability and affordability. These materials provide high thermal mass, stabilizing indoor temperatures and reducing energy demand [19]. Modular construction techniques also enable scalability and incremental growth.

Locally sourced materials reduce transportation costs and embodied energy while supporting regional economies. Brick construction remains culturally familiar and technically accessible within the Pakistani context, making implementation more feasible. In addition to thermal performance, durable materials reduce long-term maintenance requirements and improve building lifespan.

The integration of prefabricated and modular systems further enhances construction efficiency. Standardized components can reduce waste, shorten construction time, and improve quality control. Such systems are particularly beneficial for large-scale affordable housing developments where cost efficiency and speed are essential.

6.4 SMART SYSTEMS INTEGRATION

Smart technologies complement passive strategies by improving efficiency. Solar PV systems provide renewable energy, while smart metering and IoT sensors enable monitoring and optimization of energy use [26]. These systems enhance resilience and adaptability.

The integration of smart technologies is intentionally selective and practical. Rather than relying on highly complex digital infrastructure, the ASHM focuses on systems that directly improve resource efficiency and occupant well-being. Smart meters allow residents to monitor energy consumption and manage household expenses more effectively. IoT-based environmental sensors can monitor indoor temperature, humidity, and energy use

patterns, enabling more efficient building management. Solar-powered street lighting and water pumps further improve resilience during power shortages. These technologies collectively support the transition toward low-carbon and resource-efficient urban living.

7 DESIGN DEVELOPMENT

The design development phase translates theoretical concepts into a spatially coherent model. The master plan organizes housing clusters around shared green spaces, creating a balance between density and environmental performance.

The spatial organization of the project emphasizes walkability and accessibility. Pedestrian pathways are integrated with shaded green corridors that connect communal facilities, reducing dependence on motorized transport. Public spaces are strategically distributed throughout the development to encourage social interaction and create a sense of community identity.

7.1 UNIT DESIGN

Each unit is centered around a courtyard that enhances ventilation and daylight. This configuration reduces reliance on artificial cooling and lighting while improving spatial quality.

The courtyard acts as a microclimatic regulator by facilitating evaporative cooling and airflow. Interior spaces surrounding the courtyard receive filtered daylight, reducing glare and improving visual comfort. Flexible interior layouts also allow spaces to serve multiple functions according to household needs.

7.2 SECTIONAL STRATEGY

The sectional design incorporates stack ventilation, allowing warm air to rise and exit through upper openings. This passive mechanism significantly reduces indoor temperatures and improves airflow.

Double-height spaces and ventilated roof assemblies enhance vertical air movement within the building. Roof overhangs and shaded terraces provide additional protection from solar radiation while creating usable outdoor spaces. Together, these strategies contribute to a more thermally comfortable indoor environment.

8 ENVIRONMENTAL STRATEGIES

The ASHM integrates multiple environmental strategies including passive cooling, highalbedo materials, vegetation, rainwater harvesting, and solar energy systems. These strategies operate synergistically to reduce energy demand, improve water efficiency, and enhance resilience.

Rainwater harvesting systems collect and store monsoon rainfall for non-potable uses such as irrigation and cleaning. This reduces dependence on municipal water supplieswhile improving water security during shortages. Permeable surfaces and bioswales further assist groundwater recharge and reduce surface runoff.

High albedo materials are incorporated to reflect solar radiation and minimize heat absorption. Vegetation and tree planting improve outdoor comfort while reducing airborne pollutants. Renewable energy systems such as rooftop photovoltaics decrease dependence on fossil fuels and support long-term sustainability goals.

9 PERFORMANCE EVALUATION

The model demonstrates significant improvements in environmental performance. Indoor temperatures are reduced by approximately 3–5°C, while cooling energy demand decreases by up to 70% [12]. Improved daylighting and ventilation further enhance indoor comfort and reduce operational costs.

The combined effect of passive and active environmental strategies contributes to improved building efficiency and occupant well-being. Reduced energy demand lowers household utility costs, making the housing model economically sustainable over time. Thermal comfort improvements also contribute to healthier living conditions and greater productivity.

The model additionally demonstrates improved environmental resilience through reduced flood vulnerability and enhanced energy independence. These outcomes indicate that climate-responsive design can simultaneously address environmental, economic, and social challenges in rapidly urbanizing contexts.

10 SOCIAL AND ECONOMIC IMPLICATIONS

Cluster-based planning promotes social interaction and strengthens community cohesion. Incremental housing allows residents to expand their homes over time, ensuring affordability. Reduced energy consumption lowers long-term costs, making the model economically viable.

Affordable housing is not solely a question of construction cost but also of long-term operational affordability. By minimizing energy demand and maintenance requirements, the ASHM reduces the financial burden on households. Flexible expansion strategies also allow residents to adapt housing according to changing family structures and economic conditions.

Social sustainability is equally important within the proposed model. Shared spaces encourage interaction and collective responsibility, strengthening neighborhood identity and safety. Access to green spaces and improved environmental quality contributes to physical and psychological well-being, particularly for children and elderly residents.

11 DISCUSSION

The study demonstrates that affordability and sustainability are not mutually exclusive. Integrated design strategies can significantly improve housing performance without increasing costs. However, implementation requires policy support, institutional collaboration, and community participation.

One of the key challenges lies in translating research-based design principles into large-scale urban policy. Existing housing policies often prioritize rapid construction over environmental quality, resulting in inefficient urban development patterns. Greater collaboration between architects, planners, engineers, and government agencies is necessary to promote climate-responsive housing standards.

Financial accessibility also remains an important consideration. Incentives for renewable energy integration, sustainable materials, and green infrastructure can encourage wider adoption of environmentally responsive housing models. Community participation throughout the design and implementation process is equally essential to ensure that housing solutions remain culturally appropriate and socially inclusive.

12 CONCLUSION

The ASHM provides a scalable, climate-responsive solution for affordable housing in rapidly urbanizing cities. By integrating passive design, smart systems, and urban planning, it addresses environmental, social, and economic challenges effectively.

The research highlights the importance of viewing affordable housing as part of a broader sustainable urban framework rather than a purely economic issue. Through climate-responsive planning, efficient material use, and selective technological integration, the proposed model demonstrates that environmentally sustainable housing can remain accessible to low-income communities.

As cities continue to experience rapid urbanization and climate-related stress, integrated housing strategies such as the ASHM will become increasingly important. Future development policies should therefore prioritize resilient, resource-efficient, and socially inclusive housing systems capable of supporting long-term urban sustainability.

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PANEL 3

CLIMATE RESPONSIVE HOUSING AND RESILIENT URBAN FUTURES

Shehzil Khurshid[1], Faiqa Aziz[2], Sabahat Alamgir[3], Farooq Usman Shahid[4], Zeeshan Zaheer[5]

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2.Communication Officer, UN Habitat, Pakistan
3.Professor, Institute for Art and Culture
4.Principal Designer, Karawaanserai Studios
5.Assistant Professor, Comsats University

This panel discussion focused on climate responsive housing, resilient build forms, environmental adaptation, and the relationship between sustainability, design, and urban futures in Pakistan. Moderated by Shehzil Khurshid, the session brought together perspectives from academia, professional practice, and international development to reflect on how housing systems can respond more effectively to rising temperatures, environmental degradation, water scarcity, urbanization, and climate uncertainty. Throughout the discussion, climate responsiveness was not treated as a specialized architectural concern but as a broader question of governance, planning, material systems, education, affordability, and community resilience.

Shehzil Khurshid opened the session by framing climate responsive housing as an urgent necessity rather than an optional design approach. He reflected on the increasing environmental pressures facing contemporary cities, including rising temperatures, unpredictable weather patterns, and growing ecological stress. According to him, the central question is no longer whether societies should adapt to climate change, but how quickly and intelligently this adaptation can occur. He described climate responsive housing as a design approach grounded in sustainable architecture that works with natural systems such as sunlight, wind, water, and materials rather than against them. At the same time, he framed resilience as the ability of settlements and built environments to absorb shocks, recover from crises, and continue supporting communities under changing environmental conditions. Through this introduction, he positioned the discussion around the movement from theoretical ideas toward practical and adaptive housing systems capable of responding to future environmental realities.

The first major question of the session asked why most housing schemes in Pakistan continue to remain environmentally unresponsive despite increasing climate challenges. Responding to this, Dr. Sabahat Alamgir argued that one of the primary reasons is the lack of climate-related knowledge and the absence of its application within design practices. She reflected on the colonial period, explaining that although the British originated from colder climates, they still conducted extensive research into local environmental conditions before introducing housing typologies such as the bungalow into South Asia. According to her, these forms emerged through careful observation of indigenous climate conditions and local architectural practices. In contrast, contemporary housing production often ignores environmental research altogether. She argued that the issue is therefore not simply technological deficiency but a broader absence of knowledge integration and climate-sensitive thinking within architecture and planning.

Faiqa Aziz extended this critique by arguing that most housing schemes in Pakistan fail because planning processes are not scientifically informed. According to her, environmental assessments are either absent or conducted at insufficient scales, resulting in housing systems that cannot respond adequately to climate realities. She pointed out that Pakistan's rapid urbanization is intensifying pressure on urban housing systems, yet many climate-responsive experiments and research projects remain limited to villages, coastal regions, or smaller settlements rather than being integrated into dense urban environments where the majority of future housing demand will emerge. For her, climate responsiveness requires scientifically grounded planning approaches capable of operating at both local and metropolitan scales.

Farooq Usman responded to the same question by situating Pakistan's environmental crisis within broader failures of planning and ecological governance. He argued that Pakistan has become one of the countries most vulnerable to climate change precisely because planning systems have historically remained one-dimensional and environmentally disconnected. Using Lahore as an example, he reflected on how contemporary urban housing has

almost entirely abandoned environmentally responsive building traditions that once existed in older settlements and pre-partition neighbourhoods. He contrasted this with historical accounts of Lahore's gardens and environmental richness, explaining how the city once possessed ecological qualities that are now disappearing rapidly because of deforestation, unchecked development, and exploitative land practices. He pointed out that Pakistan's forest cover has fallen to critically low levels, arguing that this environmental destruction has removed the ecological systems capable of absorbing industrial carbon emissions and moderating climatic conditions. According to him, climate responsive housing cannot be separated from broader ecological restoration and environmental planning.

Zeeshan Zaheer approached the discussion from the perspective of construction systems, material experimentation, and industrialization. He argued that after industrialization, architecture increasingly shifted toward speed, mass production, and efficiency, causing traditional environmental wisdom to disappear from housing practices. Housing became reduced to repetitive systems of standard walls and roofs assembled as quickly as possible without consideration for climatic adaptation or material intelligence. In response to this condition, he argued for the reintroduction of locally responsive materials such as mud and unburnt brick alongside contemporary assembly techniques capable of producing faster yet climate-adaptive housing systems. He discussed how experimentation with monolithic systems, roofing strategies, and prototype development can help create housing models that are both scalable and environmentally responsive.

The discussion then shifted toward governance structures and institutional responsibilities. Dr. Sabahat Alamgir argued that development authorities themselves play a major role in determining whether climate-responsive systems are adopted or ignored. According to her, institutions such as DHA and other approving authorities possess the power to encourage environmentally responsive design practices through incentives, regulations, and approval mechanisms. Without institutional support and policy integration, climate-responsive strategies remain isolated experiments rather than becoming part of mainstream housing production.

Faiqa Aziz expanded this conversation by emphasizing that housing schemes must be understood as complete environmental systems rather than isolated residential units. According to her, climate responsiveness requires integrated approaches involving waste management, environmental infrastructure, tree cover, planting systems, drainage, and ecological planning. She argued that when housing schemes fail to address these broader environmental systems, they also fail to create sustainable living environments. Zeeshan Zaheer connected this point to community participation and public awareness, emphasizing that environmental systems such as grey water management, drainage systems, and wastewater disposal cannot function effectively unless communities themselves are educated and involved in these processes. Faiqa Aziz further argued that any meaningful housing initiative must operate simultaneously at three levels: the community level, the regional planning level, and the professional or institutional level. According to her, climate-responsive housing can only succeed when these three scales are connected through capacity building and coordinated implementation.

The conversation then moved toward affordability and the relationship between climate resilience and economic sustainability. Shehzil Khurshid asked how affordable housing should be redefined once the costs of climate resilience are included. Responding to this, Farooq Usman argued that affordability and sustainability cannot be separated from one another because environmental sustainability is itself a form of economic sustainability. According to him, poorly designed housing may initially appear affordable but ultimately becomes expensive because of high operational costs, energy consumption, thermal discomfort, and infrastructural inefficiencies. He argued that efficient engineering and optimized environmental design can reduce long-term living costs while improving climate resilience.

At the same time, he connected these issues to broader environmental crises such as water scarcity and agricultural degradation. He argued that unsustainable agricultural and environmental practices have disrupted natural ecological cycles, preventing water from being absorbed properly into the soil and contributing to falling groundwater levels. For him, climate-responsive housing cannot be separated from broader ecological systems because housing, agriculture, water management, and environmental sustainability are fundamentally interconnected.

The panel later turned toward practical examples of climate adaptation initiatives currently being implemented in Pakistan. When asked about UN-Habitat's role in climate resilient development, Faiqa Aziz explained that the

organization is working not only on climate-responsive housing but on broader climate-adaptive urban development systems. She discussed the Climate Resilient Settlement Plan developed for Dadu after the 2022 floods, explaining that the project focused on ensuring that resettlement strategies respond to environmental vulnerabilities and reduce future disaster risks.

She also described UN-Habitat's rainwater harvesting initiatives, including the installation of thousands of rainwater harvesting units within urban slums across Pakistani cities. Importantly, she emphasized that these projects focus not only on infrastructure installation but also on community capacity building so that communities themselves can continue implementing and maintaining these systems independently. In addition, she discussed multi-hazard vulnerability assessments conducted for cities such as Islamabad, Rawalpindi, and Nowshera, explaining that these assessments are intended to help governments prepare climate adaptation plans grounded in scientific data and risk analysis. She repeatedly stressed that climate adaptation requires collaboration between government institutions, communities, academia, and development partners, all working together through scientifically informed decision-making processes.

The discussion then returned to questions of vernacular architecture, material experimentation, and educational systems. Asked whether vernacular construction methods can compete with modern industrial systems in terms of scalability and affordability, Farooq Usman argued that vernacular systems remain highly viable if combined intelligently with contemporary engineering and industrial technologies. According to him, the question is not whether vernacular and modern systems are compatible, but how architects and engineers can create effective combinations between local materials and industrial applications. He argued that highly industrialized construction systems remain vulnerable because they depend heavily on global fuel systems and imported resources, making cities increasingly dependent on infrastructures outside their control. In contrast, locally grounded material systems may offer more resilient and adaptable alternatives in uncertain environmental and geopolitical futures.

Zeeshan Zaheer extended this conversation by discussing the role of material intelligence and experimentation within architectural education and practice. He argued that architecture schools must move beyond formal aesthetics and instead cultivate deep understandings of material properties, environmental behaviour, and structural performance. Referring to contemporary material thinkers and experimental design approaches, he emphasized that materials themselves possess behavioural logics that architects must study through testing, experimentation, and interdisciplinary collaboration. According to him, architecture schools require access to laboratories, material testing facilities, and collaborations with engineering and scientific departments so that students can understand how materials respond to humidity, heat, tension, weathering, and structural forces before applying them within design systems. He criticized the commercialization of architecture within contemporary housing markets, arguing that architecture has increasingly become reduced to surface finishes, imported materials, and market aesthetics rather than environmental performance and social responsibility.

Dr. Sabahat Alamgir shifted the conversation toward curriculum reform and argued that climate responsiveness must become a foundational aspect of architectural education rather than a specialized topic introduced later in professional training. According to her, architecture students should study climatology, geography, environmental systems, and physics from the earliest stages of education so that climate-sensitive thinking becomes embedded within their design processes. She argued that research and critical thinking require time, institutional support, and fundamental conceptual understanding. Without strong foundational knowledge, architecture students cannot meaningfully integrate environmental intelligence into their later professional and research work.

The final part of the discussion broadened the conversation from individual housing units toward urban systems, accessibility, and infrastructural planning through the keynote lecture delivered by Khurram Shehzil. His presentation connected housing affordability to transportation systems, accessibility, and urban development patterns. He argued that affordability should not be understood solely through the price of a housing unit or plot, but through a broader framework that includes accessibility to jobs, transportation systems, services, and opportunities. According to him, housing located far from employment centres may appear financially affordable but becomes economically burdensome because of long commuting times and transportation costs.

Drawing from his research on induced traffic, he argued that expanding roads does not reduce congestion in the long term but instead generates additional traffic and urban sprawl. He explained how road infrastructure shapes land values, urban expansion, commuting patterns, and housing development, particularly in rapidly urbanizing

cities such as Lahore. According to him, sustainable affordability requires integrated planning systems that connect housing, transportation, public transit, walkability, and accessibility. He argued for strengthening public transportation, non-motorized mobility systems, and equitable urban accessibility rather than continuing to prioritize road expansion and private vehicle infrastructure. In his concluding remarks, he summarized affordability as the ability of people to reach opportunities with dignity, efficiency, and fairness rather than simply acquiring cheaper housing at urban peripheries.



SESSION 4:

THEME 4:
EQUITY, CULTURE AND ALTERNATIVE HOUSING LOGICS

SESSION 4 :

THEME: EQUITY, CULTURE AND ALTERNATIVE HOUSING LOGICS

KEYNOTE :

ACCESSIBILITY IS AFFORDABILITY: INDUCED TRAFFIC AND SOCIO-SPATIAL EQUITY IN LAHORE

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INTRODUCTION

In many developing cities, the idea of affordability is still understood in a very narrow sense. A housing scheme is called affordable when land is cheaper, when plot sizes are smaller, or when a unit can be sold at a lower price than those available in the formal market. This understanding is common in policy circles and planning practice. However, it is incomplete. A dwelling may be cheap to buy, but expensive to live in. If it is located far from jobs, schools, hospitals, public transport, and everyday services, its apparent affordability can quickly disappear under the weight of daily commuting costs, lost time, transport dependence, and reduced access to opportunity (Isalou et al., 2014). This problem is highly relevant in Lahore, where urban expansion, rising motorization, and large-scale road investment have been reshaping the city over the past decade. The city has witnessed corridor widening, road dualization, ring road development, signal-free initiatives, and continuing investment in automobile-oriented transport infrastructure. At the same time, traffic volumes have kept rising, land values have changed across connected corridors, and the city has expanded outward in ways that have altered the geography of accessibility. These processes are not separate but are deeply connected (Shahzad, 2025).

This article argues that accessibility must be treated as an integral part of affordability. It further argues that road expansion affects much more than traffic flow. It influences urban form, land values, commuting patterns, and the social distribution of opportunity. In this sense, the discussion is not only about induced traffic in the traditional transport-economic sense. It is also about how transport infrastructure can shape socio-spatial inequality by making some locations more accessible, more valuable, and more connected, while leaving other households to bear the burden of distance (Pereira et al., 2017). The article draws conceptually from thesis research on the impact of road network development on traffic demand and urban spatial patterns in Punjab, with particular attention to Lahore as a spatial case. The broader thesis shows that road expansion in Punjab has not simply relieved congestion in any lasting way; rather, it has often generated additional traffic and altered the urban landscape in the process. The Lahore case is especially useful because it illustrates how major roads do not merely carry traffic; they also reorganize urban growth, influence land markets, and affect who can remain connected to the city's opportunity structure. The article specifically frames Lahore as a case where econometric findings on induced traffic can be read alongside spatial evidence on density, built-up expansion, land values, and corridor growth (Shahzad, 2025).

The central proposition of this article is simple: a house cannot be considered affordable if access to the city is expensive. This proposition has serious implications for urban planning in Lahore. It suggests that the real unit of affordability is not only housing cost, but housing cost plus travel burden plus access. It also suggests that road-led urban growth, if left unchecked by integrated planning, can deepen inequality even while appearing to improve mobility (Geurs & van Wee, 2004).

AFFORDABILITY BEYOND THE PRICE OF SHELTER

Housing affordability is often measured through price-to-income ratios, rent burdens, or the cost of land and construction. These indicators are important, but they do not tell the full story of everyday urban life. For a household, affordability is not only about acquiring shelter. It is also about maintaining a viable daily relationship with the city. The household must be able to reach employment, education, health care, markets, social networks, and public services. It must also do so within reasonable limits of time, cost, and convenience (Geurs & van Wee, 2004; Howell et al., 2018; Lucas, 2012). A peripheral housing location can reduce the initial price of land, but it may increase the long-term cost of living. Every additional kilometer from employment centers or essential services may translate into recurring transport expenses, longer commuting times, greater dependence on motorcycles or private vehicles, and more vulnerability to fluctuations in fuel cost, traffic congestion, and road safety conditions. What appears affordable in real-estate terms may therefore be unaffordable in practical terms (Blumenberg & Wander, 2022; Isalou et al., 2014).

This is why affordability should be understood through at least four linked dimensions. The first is location, meaning where housing is situated relative to jobs, schools, health care, and other daily destinations. The second is access, meaning how easily people can reach these destinations without excessive friction. The third is time, meaning how much time and money households must spend in routine travel. The fourth is fairness, meaning whether urban development expands access to opportunity or reproduces exclusion through distance and uneven connectivity (Geurs & van Wee, 2004; Pereira et al., 2017). Once these dimensions are recognized, the limits of a narrow affordability framework become obvious. A policy that delivers cheap land without adequate access may reduce the price of shelter while increasing the total burden of urban life. It may shift costs from the housing market to the transport system and then ultimately onto households themselves. In such a context, affordability becomes a misleading label (Howell et al., 2018; Isalou et al., 2014). This broader understanding is especially important in rapidly growing cities like Lahore, where the location of housing increasingly determines a household's place within the city's opportunity structure. The value of a dwelling cannot be separated from the value of access (Geurs & van Wee, 2004; Levine et al., 2017).

ROAD EXPANSION AND THE LOGIC OF INDUCED TRAFFIC

In transport planning, road expansion is commonly justified as a way to reduce congestion, improve mobility, and support economic growth. The underlying assumption is straightforward: if traffic is heavy, more road space will ease pressure and improve flow. Yet decades of transport research have shown that this assumption is only partly true, and often only for a short period (Goodwin, 1996; Hymel, 2019; Noland & Lem, 2002; Standing Advisory Committee on Trunk Road Assessment [SACTRA], 1994). The concept of induced traffic explains why. When road capacity is increased, the generalized cost of travel often falls. Travel may become faster, easier, or less frustrating, at least initially. This improvement changes behavior. Some travelers who previously avoided peak hours may begin traveling then. Some who chose shorter routes may travel farther. Some may shift from shared modes to private vehicles. New trips may be generated. Over time, households and firms may even make location decisions based on the improved corridor, leading to further travel demand (Duranton & Turner, 2011; Goodwin, 1996; SACTRA, 1994).

This is what makes induced traffic more than a traffic-engineering issue. It is a dynamic process through which infrastructure affects behavior, spatial patterns, and urban development. The thesis underpinning this article explicitly defines induced traffic as a predictable market response to lower travel costs after capacity increase, and further argues that the long-run effect involves changes in both behavior and urban form (Shahzad, 2025).

In Punjab, and especially in the more urbanized divisions, the econometric evidence in the thesis supports the existence of induced traffic. The abstract states that in divisions such as Lahore, Faisalabad, Bahawalpur, and Gujranwala, dynamic panel estimations show statistically significant short-run lane-kilometer elasticities, with high persistence in traffic demand, implying strong long-run growth in vehicle kilometers traveled after capacity additions. Lahore is among the divisions where this pattern is particularly meaningful (Shahzad, 2025).

The point is not that roads have no utility. Roads clearly improve connectivity and can support economic activity. The problem is that road expansion alone rarely solves congestion in a lasting way, especially when it is not matched with demand management, public transport, and coordinated land-use planning. In fact, when road building becomes the dominant planning response, it may lock the city into a cycle in which each attempt to relieve congestion generates the conditions for more traffic (Duranton & Turner, 2011; Hymel, 2019; Noland & Lem, 2002; SACTRA, 1994).

Lahore as a Spatial Case

Lahore offers a particularly valuable setting for examining these dynamics because it is not only Punjab's largest metropolitan center but also one of its most rapidly changing urban spaces. It combines intense land-market pressure, strong corridor development, rising motorization, and large-scale road investments. At the same time, it has experienced increasing travel burdens and persistent congestion. These features make it possible to observe how mobility infrastructure and spatial change interact over time (Shahzad, 2025).

In the study by Shahzad (2025) Lahore is treated as a spatial case where econometric findings on traffic growth are complemented by GIS-based analysis of density, land value, rental value, built-up area, and major corridors. The spatial analysis examines change within 1-kilometer and 5-kilometer buffers along key roads, including GT Road, Ferozepur Road, Raiwind Road, and other major corridors. This structure is important because it allows the researcher to observe not only traffic responses but also the geography of urban expansion and value creation around improved roads.

The key spatial finding is that Lahore's road network expansion is associated with corridor-based densification and outward built-up growth. Connected areas appear to attract more development, while land and rental values increase in locations that enjoy stronger accessibility. At the same time, traffic growth continues even after capacity additions. The study interprets these changes as evidence of an induced demand loop in which capacity expansion reduces travel cost, encourages dispersed development, and then reintroduces congestion through additional trip generation (Shahzad, 2025).

This is a crucial insight. It means that infrastructure is not simply responding to the city. It is also helping to produce the city. Roads influence where growth takes place, which locations gain value, and how accessibility is redistributed across urban space. In a city with large inequalities in income, land ownership, transport choice, and service access, these effects are unlikely to be socially neutral (Geurs & van Wee, 2004; Pereira et al., 2017; Shahzad, 2025).

FROM TRAFFIC GROWTH TO URBAN FORM

The relationship between transport infrastructure and urban form is often discussed in abstract planning language, but in Lahore it has very practical implications. When a major corridor is widened or improved, it may initially reduce friction for travel and increase accessibility to surrounding land. This improved accessibility can make adjacent areas more attractive for residential development, commercial activity, warehousing, subdivision, or speculative investment. Over time, development may begin to stretch outward along the corridor, producing linear forms of urban expansion rather than compact growth (Levine et al., 2017; Shahzad, 2025). The study by Shahzad, (2025) suggests exactly this kind of pattern in Lahore. It refers to a shift from compact urban cores toward linear suburban densification by 2023, with changes observed in population density, land values, and commuting intensity along major corridors.

Such a transformation has several consequences. First, it changes the geography of value. Better-connected corridors gain economic importance, and the land near them often appreciates more rapidly. Second, it changes the geography of housing supply. Developers and households respond to improved accessibility by locating along or near these corridors, even when public transport provision remains limited. Third, it changes the geography of travel. As urban growth stretches farther along road infrastructure, commuting distances may increase, and the city becomes more dependent on road-based mobility (Blumenberg & Wander, 2022; Geurs & van Wee, 2004; Levine et al., 2017).

This kind of road-led urbanization does not necessarily mean that the city becomes more efficient or equitable. In fact, it may do the opposite. If transport planning mainly supports outward automobile-oriented expansion, then more distant development becomes feasible, but more sustainable and socially integrated urban form becomes harder to achieve. The city may grow, but it may also become more fragmented (Levine et al., 2017; Pereira et al., 2017).

ACCESSIBILITY, LAND VALUE, AND THE DISTRIBUTION OF OPPORTUNITY

Accessibility is not just a technical variable. It is a form of urban advantage. Areas with better accessibility tend to attract more investment, command higher land values, and offer stronger connections to employment, services, and public life. In this sense, accessibility is closely linked to opportunity (Geurs & van Wee, 2004; Levine et al., 2017; Pereira et al., 2017).

This becomes especially important when land and rental values begin to rise in the most connected areas. If improved corridors make certain zones more desirable, these areas may become less affordable to lower- and lower-middle-income households. Those households may then be pushed toward more peripheral areas where land is cheaper, but access is weaker. The result is not only spatial separation. It is also a redistribution of burden (Blumenberg & Wander, 2022; Howell et al., 2018; Isalou et al., 2014).

When households are located farther from jobs and essential services, they often pay in three ways. First, they pay in money, through fuel, fares, vehicle maintenance, or multiple daily trips. Second, they pay in time, through longer commutes and less flexibility in daily life. Third, they pay in opportunity, because distance can limit access to education, health care, secure employment, and social networks. For women, students, elderly persons, and lower-income workers, these burdens can be particularly severe (Blumenberg & Wander, 2022; Lucas, 2012; Pereira et al., 2017).

This is why the phrase “accessibility is affordability” is more than a rhetorical statement. It captures a structural reality. The affordability of urban life depends on where one is located within the network of urban opportunity. A cheaper house on the edge of the city may carry hidden costs that a central or well-connected location does not (Geurs & van Wee, 2004; Isalou et al., 2014).

SOCIO-SPATIAL INEQUALITY AND THE BURDEN OF DISTANCE

One of the most important implications of the Lahore case is that infrastructure benefits are not evenly distributed. Some locations gain stronger connectivity, more investment, and rising land values. Others remain weakly served, distant from opportunity, and increasingly dependent on costly daily mobility. The result is what may be called uneven urban opportunity (Pereira et al., 2017; Shahzad, 2025). This is a form of socio-spatial inequality. It does not arise only from income differences or tenure arrangements. It also arises from the physical organization of the city itself. When roads and land markets together reshape growth in ways that privilege some locations over others, the city produces unequal access as part of its normal development process (Lucas, 2012; Pereira et al., 2017). The burden of distance is central here. Distance is not merely a matter of urban scale. It becomes a social burden when it is linked to weak public transport, unsafe pedestrian environments, rising fuel costs, congestion, or limited service distribution. For many households, especially those at the lower end of the urban income spectrum, distance can quietly consume income, time, and life chances (Blumenberg & Wander, 2022; Lucas, 2012).

In such circumstances, housing policy and transport policy can no longer be treated separately. If housing is developed in areas that are formally affordable but poorly connected, and if transport investment continues to privilege road expansion over integrated mobility, then urban inequality may deepen even without any deliberate intention to exclude (Howell et al., 2018; Pereira et al., 2017). This is one of the strongest messages emerging from the thesis-based interpretation of Lahore. The city is not only experiencing traffic growth. It is also experiencing a restructuring of accessibility and value that affects how different groups participate in urban life (Shahzad, 2025).

RETHINKING AFFORDABILITY AS LIVED URBAN EXPERIENCE

A narrow housing lens asks one main question: How much does the house cost? That question remains important, but it is inadequate for cities like Lahore. A broader urban lens asks different questions: How far is the dwelling from work? How much does daily mobility cost? How much time is lost in commuting? How well is the area connected to the rest of the city? What kind of urban life does that location allow? (Geurs & van Wee, 2004; Levine et al., 2017). These questions shift the focus from shelter price alone to what may be called lived affordability. Lived affordability recognizes that the household budget is affected not only by rent, mortgage, or land price, but also by mobility obligations created by urban form. In many cases, what is saved on housing may be lost through transport and time (Blumenberg & Wander, 2022; Isalou et al., 2014).

This concept has strong relevance for Lahore. It suggests that planners, housing agencies, and development authorities should not evaluate affordability purely through the market price of a unit or plot. They should also ask whether a project allows residents to remain connected to opportunity (Howell et al., 2018; Levine et al., 2017). This reframing has deeper implications for public policy. It changes the target of planning from simple shelter provision to opportunity-linked urban living. It also forces a more honest assessment of what low-cost peripheral expansion actually means for everyday life (Geurs & van Wee, 2004; Pereira et al., 2017).

PLANNING AND POLICY IMPLICATIONS

The implications of this analysis are both practical and strategic.

First, housing should be planned with accessibility in mind. A scheme that is physically delivered but poorly connected cannot be treated as a fully successful affordability intervention. The location of housing relative to jobs, education, health care, and high-capacity mobility must become a core criterion in planning decisions (Geurs & van Wee, 2004; Howell et al., 2018; Levine et al., 2017).

Second, land use and transport must be integrated more seriously. Road investments should not be viewed in isolation from the development they stimulate. If corridor improvements are likely to attract growth and raise land values, then planning institutions must anticipate those effects and guide them through zoning, service provision, public transport linkage, and managed growth strategies (Levine et al., 2017; Pereira et al., 2017).

Third, Lahore needs stronger alternatives to road expansion as the dominant response to congestion. The thesis itself concludes that road capacity additions in Punjab often accommodate rising traffic only temporarily and strengthen the feedback loop between mobility demand and urban form. It therefore recommends more integrated land-use and transport policy, multimodal investment, and sustainable mobility approaches (Shahzad, 2025).

Fourth, last-mile connectivity, walkability, and safe public transport access matter greatly. Accessibility is not created only by major roads. It is created by the entire chain of movement that allows a person to leave home, reach a stop or station, travel safely, and arrive at a destination without excessive time loss or risk (Geurs & van Wee, 2004; Howell et al., 2018).

Fifth, public investment should be judged not only by how much movement it enables, but by how fairly it distributes access. That means asking whether an investment widens opportunity for the many or mainly enhances value in already advantaged corridors (Pereira et al., 2017).

Finally, the policy question should not simply be "Where can more housing be built?" It should also be "Where can people live and remain connected to opportunity?" This is a more demanding question, but it is also the one that matters most for inclusive urban development (Howell et al., 2018; Levine et al., 2017).

CONCLUSION

Lahore's recent pattern of road-led growth offers a revealing lesson for urban planners and policymakers. Road expansion does not merely accommodate traffic. It also reshapes urban form, influences land and rental values, alters commuting patterns, and redistributes accessibility across the city. In doing so, it affects who can remain close to opportunity and who must bear the burden of distance (Shahzad, 2025). The thesis from which this article is drawn shows that induced traffic in Punjab is real and policy-relevant, and that Lahore, in particular, demonstrates how traffic growth and spatial transformation are part of the same urban process. What begins as a capacity intervention can end as a land-use effect, a value effect, and an equity effect (Shahzad, 2025).

This is why affordability must be redefined. A house cannot be considered affordable merely because its purchase price is lower. If the daily cost of reaching the city is high, then the household continues to pay, only in a different form. Affordability, therefore, must include access (Blumenberg & Wander, 2022; Isalou et al., 2014). The broader lesson is straightforward but important: a city becomes more inclusive not only when housing is cheaper, but when people can reach opportunity with dignity, efficiency, and fairness (Geurs & van Wee, 2004; Pereira et al., 2017). In Lahore, and in many cities like it, the future of affordability will depend not only on how much we build, but on how we connect what we build to the wider urban system. That is why accessibility is affordability (Geurs & van Wee, 2004; Levine et al., 2017).

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PAPER 1:

Optionality and Density: Demographic-Driven Housing Typologies for Resilient Urban Growth in Lahore and Comparable Megacities

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ABSTRACT

As cities confront escalating housing costs, demographic shifts, and environmental pressures, the discourse must move beyond the narrow metrics of affordability toward models that address flexibility, density, and social infrastructure. This paper examines micro-living and co-living as adaptive housing typologies that respond to contemporary urban realities while redefining affordability as spatial, social, and ecological resilience.

Micro-living offers compact, efficiently designed units that accommodate temporary and transitional populations, including migrant workers, inter-city transient professionals, overseas residents seeking pied-à-terre apartments, young adults, and students. By prioritizing location, flexibility, and shared amenities over private square footage, these models provide viable access to urban centers without replicating the spatial excess of conventional housing. Planning for these compact units in a mixed housing development can provide more optionality in a safe and healthy way.

The paper examines Carmel Place, New York City's first micro-housing prototype, as a case study for cities that are rapidly densifying and building vertically. Developed using modular construction techniques, the project demonstrates how off-site fabrication can accelerate delivery timelines, improve construction precision, and reduce neighborhood disruption while providing an additional housing typology that reflects the shifting demographics of New York. A demographic that is willing to sacrifice floor space for a preferred location and building community.

Co-living extends this framework through shared kitchens, communal dining areas, and collective entertainment zones that reduce operational costs and encourage social cohesion. Such configurations are inherently resource-efficient: shared infrastructure lowers material consumption, optimizes energy use, and supports more sustainable patterns of habitation. These models also enable varied levels of service and staffing, accommodating diverse economic capacities within a single development.

Critically, co-living offers an intergenerational housing strategy that addresses the growing inadequacy of senior housing while challenging the persistence of the nuclear family as the dominant design assumption. In many cultural contexts where joint family systems remain prevalent, shared housing arrangements reflect lived realities more accurately than isolated units. By designing for existing social structures rather than idealized ones, co-living fosters care networks, reduces social isolation, and strengthens urban community resilience. This paper asks whether the co-living framework can be reconfigured to support multi-headed households—extended families, blended families, and cooperative living groups—thereby expanding its applicability beyond young professionals to more diverse and interdependent domestic structures.

Positioned as instruments of densification and cultural responsiveness, micro-living and co-living reframe housing not merely as shelter, but as shared urban infrastructure. Together, they propose a pathway beyond affordability toward inclusive, sustainable, and socially integrated urban futures.

KEYWORDS:

Affordable housing; Lahore; urban density; micro-housing; co-living; resilient urbanism; demographic-driven design

INTRODUCTION:

Cities across the world are confronting unprecedented urban growth, housing shortages, and escalating affordability crises. These pressures are particularly acute in rapidly urbanizing regions of the Global South, where population growth frequently outpaces the capacity of housing production, infrastructure, and governance systems. In many cities, the result is a polarized urban condition characterized by luxury high-rise development on one end and low-density peripheral sprawl on the other. Neighborhoods are increasingly shaped by economic and political stratification, resulting in unequal access to public infrastructure, services, and institutional support. This condition weakens urban cohesion, intensifies inequality, and places immense pressure on environmental systems and transportation infrastructure.

Lahore exemplifies these dynamics. With a population approaching 13 million, approximately two million households, and a growth rate of 2.65 percent, the city has expanded by over 116 percent since the 1998 census and is now classified as a "fast-growing megacity." The scale and speed of this growth raise urgent questions about how cities such as Lahore can accommodate increasing density while preserving affordability, social diversity, and environmental resilience.

Traditional housing production models in South Asia have often centered around assumptions of nuclear family structures and low-rise expansion. Yet demographic realities are shifting. Increasing migration, smaller household sizes, delayed marriage, aging populations, transient labor markets, and changing economic conditions demand greater diversity in housing typologies. Simultaneously, climate change and infrastructure limitations make continued outward sprawl increasingly unsustainable.

This paper argues that resilient urban growth requires a rethinking of housing beyond conventional affordable housing frameworks. Rather than viewing density as inherently problematic, the paper proposes that density—when combined with optionality, mixed-income integration, and demographic responsiveness—can become a tool for affordability and urban resilience. The paper examines alternative housing models including micro-housing, co-living, modular construction, and multigenerational housing through comparative case studies from New York City and London. These examples are analyzed not as direct templates for Lahore, but as conceptual frameworks that may inform adaptive and culturally grounded housing strategies.

The paper addresses the following research question:

How can demographic-driven housing typologies support affordability, resilience, and inclusive urban growth in rapidly expanding cities such as Lahore?

The paper is structured into six sections. Following this introduction, the literature review examines debates surrounding density, affordability, housing typologies, and resilient urbanism. The methodology section outlines the comparative case study approach. The analysis section evaluates the case studies and their relevance to Lahore across policy, technological, environmental, and socio-spatial dimensions. The discussion critically reflects on the transferability and implications of these models. Finally, the conclusion synthesizes the findings and proposes future directions for housing policy and urban design.

DENSITY AND THE CONTEMPORARY HOUSING CRISIS

Urban density has long occupied a contested position within planning and architectural discourse. Modernist planning traditions often associated density with overcrowding, poor sanitation, and social disorder, particularly in the context of industrial-era tenements. Postwar suburbanization reinforced the idea that more space equated to improved quality of life. This ideology shaped zoning regulations, minimum unit sizes, and low-density development patterns across many global cities.

However, contemporary scholarship increasingly recognizes that low-density expansion generates its own crises, including automobile dependency, infrastructural inefficiency, ecological degradation, and socio-spatial segregation. Scholars such as Edward Glaeser and Richard Florida argue that density, when paired with effective planning and transit systems, can support economic productivity, sustainability, and social interaction.

In rapidly urbanizing contexts, the question is therefore not whether density should exist, but what forms density should take. Poorly managed density can exacerbate inequality and displacement, while strategic density

can increase housing supply, reduce land consumption, and support mixed-use urban vitality.
The presentation underpinning this paper highlights this tension directly, describing a condition in which cities face "urban fight or flight: luxury towers or sprawl." This binary often excludes middle-income and low-income residents while weakening urban cultural and commercial cores.

HOUSING TYPOLOGIES AND DEMOGRAPHIC CHANGE

A central issue in contemporary housing discourse concerns the mismatch between existing housing stock and changing demographic realities. In many cities, housing policy continues to prioritize the nuclear family unit despite growing diversity in household composition.
In New York City, for example, approximately 60 percent of households consist of one or two people. Yet much of the city's housing stock was historically designed around larger family structures. Similar demographic shifts are increasingly visible globally, including in South Asian cities where migration, economic pressures, and changing social patterns are altering household structures.

Housing typologies such as micro-housing and co-living emerge in response to these demographic transitions. Micro-housing reduces private unit size while expanding shared amenities and urban accessibility. Co-living models similarly combine smaller private spaces with extensive communal infrastructure and flexible lease structures. These models attempt to balance affordability, social interaction, and spatial efficiency.
Critics argue that such typologies risk normalizing reduced living standards or commodifying community. Others suggest they primarily serve affluent young professionals rather than structurally addressing affordability. Nevertheless, proponents contend that these models provide critical flexibility within constrained urban land markets.

RESILIENT URBANISM AND OPTIONALITY

Resilience theory has become increasingly influential within urban planning discourse. While early resilience frameworks focused primarily on environmental adaptation, contemporary approaches emphasize social, economic, and infrastructural resilience as interconnected systems.
Within housing discourse, resilience involves the capacity of urban systems to accommodate demographic shifts, climate pressures, economic instability, and changing patterns of work and mobility. Optionality or the availability of multiple housing forms and rental arrangements becomes essential to resilient urban systems.
The concept of optionality challenges standardized housing production by proposing diversified typologies responsive to different life stages, income levels, and household structures. This framework aligns with inclusive urbanism theories emphasizing mixed-income integration, social diversity, and adaptable urban form.
The presentation's concluding argument that "more housing options leads to more affordability" and that density must be built "with intention, driven by data" reflects this theoretical orientation.

IDENTIFIED GAPS

Despite extensive scholarship on affordable housing and density, several gaps remain. First, many discussions of innovative housing typologies are centered in Western contexts and insufficiently adapted to Global South urban conditions. This includes construction methodology, operating frameworks and housing market financial structures. Second, affordable housing debates often focus narrowly on unit cost rather than broader issues of demographic responsiveness and social infrastructure. Third, limited scholarship addresses how culturally specific forms of collective living, such as multigenerational households common in Lahore, might intersect with emerging housing typologies. The limited availability of census information and reliable urban data in cities such as Lahore also constrains the ability of housing policy and development strategies to respond meaningfully to changing demographic realities.
This paper positions itself at the intersection of urban density, demographic change, and resilient housing design by exploring how alternative housing models might be translated into culturally responsive frameworks for Lahore.

METHODOLOGY

This research employs a qualitative comparative case study methodology combining urban policy analysis, architectural typology analysis, and demographic interpretation. The methodology is interdisciplinary, drawing from urban design, housing policy, architecture, and planning theory.

The paper uses Lahore as the primary urban context while examining comparative precedents from New York City and London. The objective is not to replicate Western housing models directly, but to analyze transferable principles relating to density, affordability, and demographic responsiveness.

Two principal case studies were selected:

1. Carmel Place, New York City
2. The Collective Old Oak, London

These projects were selected because they represent distinct yet complementary approaches to housing innovation:

- Carmel Place demonstrates policy-enabled micro-housing and zoning reform.
- The Collective demonstrates co-living as a density-driven and market-responsive housing typology.

DATA SOURCES

The primary source material for this paper draws from the author's direct involvement in the design, approval, and construction of Carmel Place, New York City's prototype micro-housing project, where she served as Project Lead. This experience is further informed by the author's subsequent role as Director of Architecture at The Collective, a global co-living development company that explored large-scale shared living models across multiple cities. Additional contextual information is synthesized from urban planning scholarship, demographic studies, and housing policy literature.

Additional data was drawn from census information relating to Lahore and New York City, as well as from New York City zoning policies concerning Mandatory Inclusionary Housing and density regulations.

LIMITATIONS

Several limitations should be acknowledged. First, the research relies primarily on secondary analysis and conceptual interpretation rather than fieldwork or interviews. Second, comparative case studies from New York and London operate within vastly different governance, economic, and regulatory environments than Lahore. Third, some emerging housing typologies remain experimental and may not yet have sufficient long-term performance data.

ETHICAL CONSIDERATIONS

The paper recognizes that housing is not merely an economic commodity but a social and cultural right. Discussions of densification and reduced unit size must therefore be approached critically to avoid legitimizing exploitative or inadequate living conditions. The research also acknowledges the need for culturally responsive housing design that respects local social practices and family structures.

POLICY AND GOVERNANCE

One of the most significant findings emerging from the case studies is the central role of policy reform in enabling innovative housing typologies. In New York City, Carmel Place emerged through the adAPT NYC initiative launched under Mayor Michael Bloomberg in 2012. The initiative sought to test small and adaptable housing models on underutilized public land.

The project catalyzed changes to the New York City Zoning Resolution, including the removal of the former 400-square-foot minimum apartment requirement. Unit size thereafter became governed by ADA accessibility standards, habitability requirements, and plumbing codes, enabling practical minimums closer to 250 square feet. This policy shift illustrates that affordability is not solely determined by subsidies but also by regulatory flexibility. Zoning regulations often encode outdated assumptions regarding household structures and spatial requirements. By revising these assumptions, cities can expand housing supply and typological diversity.

Additionally, Carmel Place incorporated a mixed-income model in which 30 percent of units were designated affordable, including Section 8 voucher housing. Affordability ratios were shaped through community board nput, housing advocacy, and municipal governance structures. This demonstrates how density can support inclusion when affordability mandates are integrated into development frameworks.

For Lahore, these findings suggest the need for zoning reform that permits greater typological experimentation. Existing planning regulations frequently privilege detached or conventional apartment typologies while restricting density and mixed-use development. Regulatory systems could instead encourage:

- Reduced minimum unit sizes
- Shared amenity incentives
- Flexible household configurations
- Mixed-income development mandates
- Transit-oriented density

Such reforms would require institutional coordination between housing authorities, municipal governments, developers, and civil society.

Technological and Systemic Innovation

The case studies also reveal how technological systems can support affordable density. Carmel Place employed modular construction, with units fabricated off-site and stacked within four weeks. This reduced neighborhood disruption, improved quality control, and accelerated construction timelines.

Modular construction offers several advantages relevant to rapidly urbanizing cities:

- Reduced construction waste
- Faster project delivery
- Potential cost efficiencies
- Improved labor safety
- Scalability

In contexts such as Lahore, where construction quality and construction pollution remain persistent challenges, modular and prefabricated systems may offer opportunities for more efficient housing production. However, successful implementation would require industrial infrastructure, workforce training, and supply chain development.

The Collective represents another form of systemic innovation through data-driven spatial programming. The project optimized ratios between private and communal space based on user behavior and demographic preferences. Shared amenities included communal kitchens, lounges, restaurants, and event spaces.

Importantly, these systems challenge conventional assumptions regarding ownership and domesticity. Rather than maximizing private square footage, the model redistributes resources toward shared infrastructure. This approach increases density while maintaining livability.

The Collective also demonstrates how flexible lease structures and all-inclusive rental agreements respond to transient populations such as students, digital nomads, and young professionals. As urban labor markets become increasingly mobile and precarious, housing systems must adapt to greater fluidity in residency patterns.

CLIMATE AND ENVIRONMENTAL IMPLICATIONS

Housing typologies have significant environmental consequences. Low-density suburban expansion consumes agricultural land, increases automobile dependency, and expands infrastructural footprints. In Lahore, unchecked urban sprawl threatens ecological systems, increases transportation burdens, and intensifies urban pollution with critical air quality issues.

Higher-density housing models can support environmental resilience in several ways:

- Reduced land consumption
- Lower per-capita infrastructure costs
- Greater transit viability
- Improved energy efficiency

- Reduced commuting distances
- Lower construction pollution, if combined with offsite modular fabrication

Micro-housing and co-living models additionally reduce material consumption by decreasing private unit sizes and increasing shared resource utilization.

However, density alone does not guarantee sustainability. Poorly designed dense environments can produce overheating, inadequate ventilation, insufficient open space, and social stress. Environmental resilience therefore depends upon design quality, passive environmental strategies, access to daylight, ventilation, and communal green space.

The presentation emphasizes that Carmel Place compensated for reduced private space through larger windows, taller ceilings, storage optimization, and expanded communal areas. This suggests that qualitative design improvements are essential when increasing density.

SOCIAL AND SPATIAL EQUITY

Perhaps the most critical dimension concerns social equity. Housing typologies shape not only affordability but also social relationships, access to opportunity, and urban belonging.

The presentation critiques urban systems that produce polarized housing outcomes: luxury towers in central, desirable neighborhoods for elites and urban sprawl for everyone else. Such stratification weakens neighborhood diversity and urban vitality.

Mixed-income housing models challenge this segregation by integrating different income groups within shared developments. The 80/20 and Mandatory Inclusionary Housing frameworks in New York attempt to embed affordability directly into private development.

At the same time, co-living models offer an alternative approach to affordability for single-person households seeking access to desirable urban neighborhoods that might otherwise remain financially inaccessible. By combining smaller private units with shared amenities and services, these developments can reduce individual housing costs while maintaining proximity to employment, transit, and cultural infrastructure. The model also offers useful insights into communal living, shared space efficiency, and housing that responds more directly to changing urban demographics.

One of the most compelling implications for Lahore concerns multigenerational living. The paper asks: "What would housing look like for a culture that integrates multigenerational living?" This question highlights the limitations of importing Western nuclear-family assumptions into South Asian contexts.

In Pakistan, extended family structures remain socially significant despite urban transformation. Housing systems that combine private autonomy with collective living may therefore offer culturally resonant alternatives. Possible models include:

- Cluster apartments
- Shared courtyards
- Interconnected multigenerational units
- Hybrid live-work arrangements
- Flexible room configurations

These typologies could increase affordability through shared infrastructure while preserving cultural patterns of care and kinship.

DISCUSSION

The findings suggest that resilient urban growth depends not only on increasing housing quantity but on diversifying housing typologies in response to demographic realities. Conventional affordable housing models often focus narrowly on cost reduction while leaving broader assumptions about domesticity, household structure, and urban form unchallenged.

The case studies demonstrate that density can become a productive urban strategy when integrated with thoughtful policy reform, design quality, and social infrastructure. Carmel Place illustrates how regulatory flexibility can enable new forms of affordable density, while The Collective demonstrates the market viability of shared-space models responding to changing urban lifestyles.

However, the transferability of these models to Lahore requires caution. Economic conditions, cultural norms, governance systems, and housing markets differ substantially. Western co-living models oriented toward digital nomads may not directly address the needs of lower-income urban populations in Pakistan.
Nevertheless, several transferable principles emerge:

DEMOGRAPHIC-DRIVEN PLANNING
Housing systems must respond to actual demographic conditions rather than outdated assumptions. Single-person households, students, migrants, seniors, and multigenerational families all require different forms of housing.

OPTIONALITY AS AFFORDABILITY
Affordability is enhanced not only through subsidies but through expanded choice. A broader range of housing options allows households to select configurations aligned with economic and social needs.

DENSITY AS INFRASTRUCTURE EFFICIENCY
Strategic density supports transportation efficiency, reduced ecological impact, and stronger urban economies. Sprawl, while often perceived as affordable, generates hidden infrastructural and environmental costs.

SHARED SPACE AS URBAN RESOURCE
Shared amenities can enhance quality of life while reducing private spatial requirements. However, successful communal systems depend on careful management, cultural compatibility, and equitable access.

REGULATORY REFORM
Zoning regulations strongly shape affordability outcomes. Reforming minimum unit sizes, parking requirements, and mixed-use restrictions may significantly expand housing possibilities.

Importantly, density must be pursued ethically. Reduced unit sizes should not justify exploitative housing conditions or diminished living standards. Design quality, daylight, ventilation, accessibility, and communal infrastructure remain essential.
For Lahore, the challenge is therefore not simply to densify, but to develop culturally grounded, climate-responsive, and socially inclusive density models capable of supporting long-term urban resilience.

CONCLUSION

This paper has examined how demographic-driven housing typologies can contribute to resilient urban growth in rapidly expanding cities such as Lahore. Through comparative analysis of micro-housing and co-living case studies from New York City and London, the research demonstrates that affordability, density, and resilience are deeply interconnected urban challenges.
The findings indicate that conventional housing models centered on nuclear-family assumptions no longer adequately reflect contemporary urban demographics. Innovative typologies such as micro-housing, co-living, modular construction, and multigenerational housing provide alternative frameworks capable of increasing affordability, spatial efficiency, and social diversity.
The research further demonstrates that density should not be understood solely as a quantitative condition but as a qualitative and political one. Density becomes beneficial when supported by:

- Inclusive zoning policy
- Mixed-income integration
- Shared social infrastructure
- Environmental responsiveness
- Demographic adaptability

For Lahore, the implications are significant. Continued low-density expansion is unlikely to provide sustainable or equitable housing solutions. Instead, future housing policy must embrace optionality and typological diversity while remaining grounded in local cultural and social realities.

The paper contributes to affordable housing discourse by reframing density as a strategic urban resource rather than a problem to be mitigated. It also highlights the importance of integrating demographic analysis into housing design and policy frameworks.
Future research should explore:

- Locally adapted multigenerational housing prototypes
- Financial models for mixed-income housing in Pakistan
- Climate-responsive dense housing systems
- Resident experiences within emerging typologies
- Regulatory reforms enabling typological experimentation

Ultimately, resilient urban growth depends not simply on building more housing, but on building housing systems capable of accommodating the complexity, diversity, and transformation of contemporary urban life.

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PAPER 2:

Applying a Housing Quality Assessment Framework for Marginalized Communities Architectural, Spatial, and Socio-Cultural Insights from Hindu Settlements in Karachi

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ABSTRACT

This study critically examines housing conditions in marginalized urban communities by transcending traditional affordability-oriented models into a multidimensional conceptualization of housing as a socio-spatial and architectural process. The study draws on socio-spatial theory, urban morphology, and housing studies to develop a comprehensive conceptual framework of housing that considers it from architectural, spatial, and socio-cultural perspectives. The framework is operationalized into measurable indicators and applied to three Hindu settlements in Karachi: the Swaminarayan Temple Residential Complex, Narayanpura Hindu Enclave, and Tabela Housing Cluster. Data was gathered through household surveys, semi-structured interviews, and spatial documentation, using a qualitative comparative case study approach. The findings reveal that, in addition to physical aspects, cultural practices, religious identity, and collective spatial organization also determine housing logics that oppose the standardized planning and design practices. The paper brings out the relationship of architectural form and spatial morphology with the socio-cultural dynamics that shape livability as well as community resilience. Foregrounding these associations, the study contributes to the discourse of urbanism by suggesting a culturally responsive and spatially sensitive housing assessment framework and implications of inclusive design and contextual urban development in the Global South.

KEYWORDS:

Cultural Identity, Hindu Settlements, Housing Quality Assessment, Socio-spatial marginalization.

INTRODUCTION:

Habitable housing and the 'Quality of Life' that it provides bring forth the concept of 'QUALITY OF HOUSING' (Sinha et al., 2017). The housing settlement, as an active social-spatial entity, is composed of the interrelations among built form, social organization, and cultural meaning (Zhang, Yang, & Yi, 2024). Built form, spatial configuration, and daily life create patterns of habitation that result from both historical processes and present realities (Brown & Brown, 2004). Assessment of housing quality is an important strategy for evaluating how settlement communities are exposed to the built environment and resources, and for negotiating social identities within urban centres (Hwang, 2016).

The housing quality assessment of socio-economically disadvantaged urban populations, including religious minorities, slum dwellers, and low-income households, demonstrates spatial exclusion, unstable tenure, and overcrowding of the housing, and infrastructural deprivation, which are often disregarded and not usually considered within the framework of planning (Soyinka, Oluwole, & Siu, 2018). Housing quality assessment has become more accepted as a way of defining not only the physical state of housing but also the spatial, cultural, and social environment that shapes the existence of minority groups in South Asian cities (Mehfooz, 2021). This is

approximately compelling a deeper scrutiny not only of their background of marginalization, but of the urban dynamics at play today in the housing environment of the Hindu population of Karachi (Waraich et al., 2020).
The Hindu community is 6 to 8 million in Pakistan and the second-largest religious minority of the nation, as well as a significant part of the cultural and historical heritage (Tahir and Tahira, 2016). This is a visibly active community in Karachi, Pakistan, particularly in areas such as Narayanpura, Ranchore Line, and Lyari. Even though Buddhists once played a more classic role in the city economy and identity, the Hindu community in Karachi is both weakly and socially marginalized (Waraich et al., 2020). Over the years, rapid urbanization, socio-political marginalization, and religious discrimination have increased the vulnerability of most ageing Hindus to insecurity because of their placement in informal settlements (katchi abadis), which are overcrowded, underdeveloped, and prone to natural and human-induced disasters (Hasan, 2019; Niazi, Farhat &Azad, 2018).
The current housing policies in Karachi tend to use standardized models that fail to recognize cultural diversity and the unique requirements of minority groups, thus supporting the trend of exclusion (Hasan, 2016). To Hindu communities, shelter is not just a place to stay, but a place to express their culture, maintain their identity, and unite socially (Khan, Nazir, & Iqbal, 2024). Nevertheless, integrated frameworks to evaluate housing in architectural, spatial, and socio-cultural terms do not exist, as most research examines them separately. This paper fills this gap by formulating and implementing a multidimensional housing evaluation model to three Hindu settlements in Karachi: Swaminarayan Temple Residential Complex, Narayanpura Hindu Enclave, and Tabela Housing Cluster, which represent diverse settlement types. In this manner, the study will help to gain a holistic view of housing conditions and inform inclusive and culturally responsive housing strategies.

2. THEORETICAL FOUNDATIONS

2.1 Housing as a Socio-Spatial System

Contemporary housing studies conceptualize housing as a socio-spatial system in which physical attributes, spatial patterns, and social activities are closely related (Kutty, 1999). Based on the socio-spatial theory, especially the idea of space being socially constructed, the housing environments can be viewed as both a product of material circumstances and cultural practices (Lefebvre, 1991; Karsten, 2007). A more integrated approach includes interconnected philosophies of architectural, demographic, economic, and political as well as ecological factors, through integration of sectoral and distinct perceptions of housing quality (Lawrence, 1995; Dempsey, 2009). This approach is critical of traditional methods that see housing as a single physical entity, but focus on the importance of examining how built form is functioning in relation to daily life, social relations, and identity construction. This interaction is especially visible in marginalized settlements, where residents constantly modify their housing conditions and conditions to meet economic limits, cultural traditions, and social groups (Waraich, 2020). Therefore, a comprehensive housing assessment must integrate multiple dimensions that reflect both tangible and intangible characteristics of living environments, namely architectural, spatial, and socio-cultural (Sinha et al., 2017; Lehtonen, 2015; Wimalasena et al., 2022).

2.2 Architectural Characteristics

Architectural characteristics are part of the housing quality evaluation for marginalized communities, in essence, because they have direct impacts on the safety of the structure, comfort in the environment, health conditions, and satisfaction of the residents (Sinha et al., 2017). The literature stresses that building form and structural stability are key pointers, especially in lower-income and marginalized settlements where there are informal constructions and extensions (Chitengi, 2016; Wekesa et al., 2011). The decision on construction materials has been extensively talked about as a driver of longevity, cost of maintenance, and thermal performance in the urban environments of the Global South, often operating in the face of affordability instead of performance, influencing housing quality (Kajjoba et al., 2025). Also, the lack of exposure to daylight and insufficient ventilation are linked to overheating, humidity, and lower quality of the indoor environment, particularly with smaller typologies of

housing (Ortiz et al., 2020; Santamouris & Kolokotsa, 2015). According to the researchers, the exterior and the aesthetics of housing have a socio-psychological function, especially within the minority population (Mehfooz, 2021). It is further stated that facades are interpreted as pride and a sense of belonging, which affect the attachment and pride of a resident to the place (Amjad et al., 2021). Lastly, environmental adaptation, including heat, rain, and humidity responsiveness, is being identified as one of the major architectural determinants of resilience in climate-prone cities, such as Karachi (Hasan, 2019).

2.3 Spatial Characteristics

Spatial characteristics are an important aspect of housing quality evaluation for marginalized communities because they determine the daily functionality, comfort, security, and social interaction in residential contexts (Sinha et al., 2017). The literature cites internal space organization, such as room size, layout, and flexibility, as one of the determinants of housing adequacy, especially in high-density urban settlements, where households are frequently multi-generational (Amerigo & Aragones, 1997; Diener & Suh, 1997). Poor internal spatial organization has also been associated with a lack of privacy, conflict of functions, and decreased residential satisfaction (Chen & Fang, 2024). The external spatial relationships, like courtyards, streets, and common open spaces, are fundamental to the marginalized communities, besides the dwelling unit. Such spaces facilitate social interaction, informal economic activities, and cultural practices, particularly in situations where the indoor space is minimal (Mehfooz et al., 2021). According to the scholars, the quality and functionality of the semi-public space are one of the key determinants of both comfort and neighborhood cohesion (Amjad et al., 2021). Circulation and connectivity of the dwelling and the neighborhood are also highlighted in the literature about housing, as women, children, and the elderly may lack mobility due to narrow lanes, staircases, and a lack of connectivity, and emergency access will be limited (Roy et al., 2024).Lastly, the environment, comfort, and safety, such as perceived cleanliness, level of noise, and safety at various times of the day, have a strong impact on the overall housing satisfaction and well-being (Chen & Fang, 2024; Amjad et al., 2021).

2.4 Socio-cultural Characteristics

Socio-cultural characteristics create a critical aspect of housing quality evaluation for marginalized communities, because housing is not just a physical housing but also a socializing area, cultural expressiveness, and sense-making (Sinha et al., 2017). It is stressed in the literature that housing use and satisfaction are strongly dependent on family structure and dynamics, especially in marginalized and minority communities (Mehfooz et al., 2021). Researchers emphasize that housing accommodating rituals, festivals, and daily culture-related practices has a beneficial impact on the feelings of continuity and emotional stability of residents, which emphasizes identity preservation (Tahir & Tahira, 2016). Also, good neighbourhood connections improve mutual aid, a sense of safety, and resilience to form a collective community, especially in inner-city high-density regions (Hasan, 2019). In the same vein, gendered space is a critical socio-cultural determinant, such that housing designs that do not offer privacy and safe areas have a disproportionate impact on women and girls, which restricts their involvement both in domestic and social life (Karsten, 2007; Dempsey, 2009; Roy et al., 2024). Housing experiences are also influenced by religious needs and the spatial aspects of the settlements, with the closeness to worship areas and taking part in the preservation of the culture (Raschid et al., 2015). Lastly, a sense of belonging and well-being becomes an integrative effect of socio-cultural adequacy, and it affects the attachment of residents to place and readiness to invest in their houses (Hasan, 2019; Roy et al., 2024).

3. CONCEPTUAL FRAMEWORK AND OPERATIONALIZATION

This study adopts an integrated conceptual framework to assess housing quality in marginalized settlements by linking theoretical insights with empirical analysis. It is theoretically grounded in three complementary perspectives: socio-spatial theory, which conceptualizes housing as a socially produced space (Lefebvre, 1991); urban morphology, which examines the physical structure and spatial organization of settlements (Hasan, 2019); and housing studies, which address issues of informality, cultural and economic marginalization, and livability in the Global South (UN-Habitat, 2018). The framework does not see housing as a physical object but as a socio-

spatial object that is situated in the context of larger urban and cultural objects.
The framework is organized with respect to three dimensions that are intertwined, that is, architectural, spatial, and socio-cultural. These dimensions are operationalized by a group of qualitative measures that help to collect and interpret data systematically. The framework is implemented on three Hindu settlements in Karachi, which enables a comparative evaluation of the housing conditions in various typologies. The framework, as shown in Figure 1, connects the larger city context to housing as a socio-spatial order and to quantifiable analytical typologies, which give an organized point of departure to determine spatial, architectural, and cultural discontinuities and to inform comprehensive and context-driven housing policies.

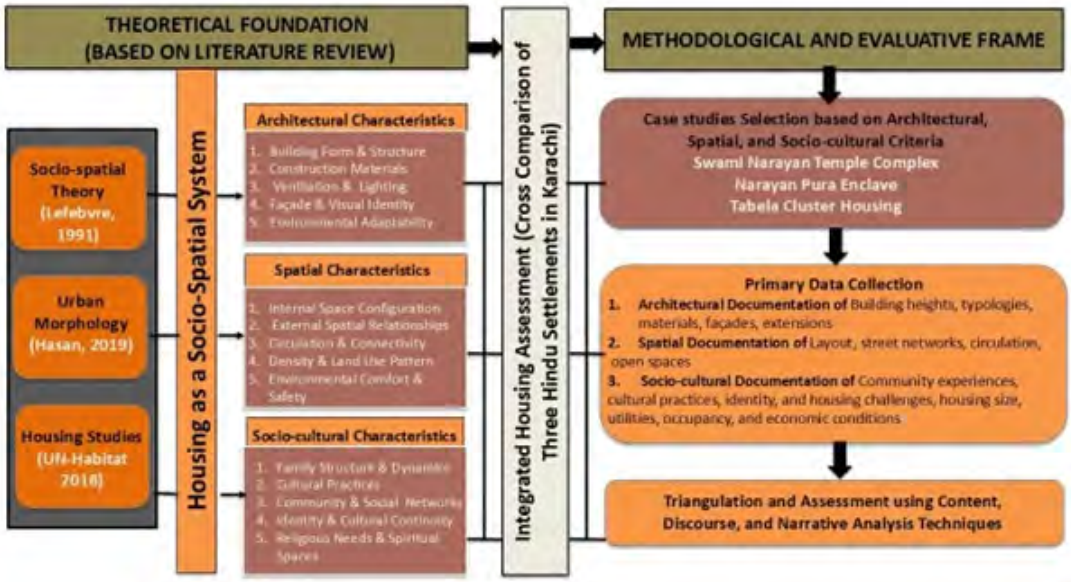


Figure 1: Conceptual framework illustrating the integrated assessment of housing through architectural, spatial, and socio-cultural dimensions, linking urban context to comparative analysis

4. MATERIALS AND METHODS

A qualitative comparative case study design is used in this study to evaluate the level of housing in three Hindu settlements in Karachi, which include Swaminarayan Temple Residential Complex, Narayanpura Hindu Enclave, and Tabela Housing Cluster. These case studies have been chosen to reflect the different typologies of settlements and allow a full comparison of different architectural, spatial, and socio-cultural settings. The study is informed by a comprehensive conceptual framework that operationalizes housing assessment along three main dimensions: architectural features, spatial layout, and socio-cultural. All the dimensions are converted into certain indicators to provide a systematic analysis. The research strategy is divided into four phases.

4.1. Literature Review

Phase 1 entailed an overall literature review in order to gain a theoretical and analytical background of the housing evaluation of Hindu settlements in Karachi. A systematic review of peer-reviewed journal articles, books, policy reports, and institutional documents was conducted to review important concepts on housing assessment, marginalized and minority housing, and spatial, architectural, and socio-cultural aspects of residential settings. The review led to the identification and refinement of the use of assessment indicators and determinants in this study to ensure that they were relevant to the minority settings. The literature on the socio-political location of Hindu communities in Karachi was also analyzed to put the areas of the case into perspective. This stage allowed creating a detailed analytical framework, which combines objective housing features and the subjective perceptions of the residents, thus informing the next stages of collecting field data and comparing it.

4.2.Case Studies Selection

Phase 2 of the study focused on selecting relevant case studies for cross-comparison. The Saddar Town is the center of Karachi, which has been strategically selected to be the lynchpin in this study since it is the historic center of Hindu settlement, multiethnicity, and architectural flexibility in the city. All the chosen case studies,

waminarayan Temple Residential Complex, Narayanpura Hindu Enclave, and Tabela Hindu Housing Cluster, lie in or near Saddar, which allows for a logical comparative analysis of the Hindu population of Karachi in the colonial and the modern era. All three settlements of the Hindu community in Karachi, Pakistan, are shown in Figure 2 below.



Figure 2: Geographical distribution of the three Hindu housing settlements under study

The Swaminarayan Temple Complex of the late 19th century represents a strictly designed religious residential typology, traditional Hindu architecture mixed with colonial influences, a system of organized courtyards, and kin networks around temples. Conversely, Narayan Pura, which was developed in the early 20th century, is a vernacular and community-driven enclave where temples have been woven into residential fabric, and where social cohesion among caste and class remains high. The Tabela Housing Cluster, which developed after the Partition, implies that the informal and survivalist stage of Hindu settlement is marked by self-constructions, the domestic level spirituality, and socio-economic precarity. Although the extent of formality and heritage significance differs, all settlements face the problems of infrastructure deterioration, congestion, encroachment, and state neglect, which highlights their common susceptibility to forces of urban development.

4.3.Data Collection Methods

Phase 3 of the study used a mix of qualitative and spatial research to record the architectural, spatial, and socio-cultural characteristics of Hindu settlements in Karachi. Extensive semi-structured interviews among community leaders, elders, and long-term residents were conducted to capture information about the socio-cultural parameters. Architectural and socio-cultural indicators were analyzed by using information on housing conditions, utilities, patterns of occupancy, economic constraints, and culturally influenced spatial consumption that was obtained by conducting structured household surveys. Moreover, site visits were an essential component of the spatial research tool, as they allowed the comprehensive mapping of the spatial area, recording of the area via photography, and direct observation of settlement structures, circulation, division of plots, form of buildings, the use of materials, and conditions of the environment.

4.4.Cross-Comparison Analysis

The combined data collection tools allowed for a triangulated and comprehensive comparative assessment of the settlements across three indicators of architecture, space, and socio-culture.

5. RESULTS AND ANALYSIS

The comparative analysis is categorically organized according to three characteristics and their related indicators: architectural, spatial, and socio-cultural for assessing the Swaminarayan Temple Residential Complex, Narayanpura Hindu Enclave, and the Tabela Hindu Housing Cluster.

5.1.Comparative Housing Assessment of Architectural Indicators

- **Building Form and Structure**

The Swami Narayan Temple Residential Complex has structured building shapes that are mostly G+1 and G+2 in height, and the forms are frequently laid out around the temple as a key institutional focus. The structures are mostly permanent and have more distinct load-bearing structures and fewer ad hoc vertical extensions, which adds to an increased structural safety. The Narayan Pura, on the other hand, is exhibiting natural and organic development, in which the buildings have been extended several times throughout the years with G+1 and G+2 in height. Although this is a sign of flexibility, it has led to structural anomalies and the fears of the residents with regard to the long-term stability. The Tabela Housing reflects the weakest building shapes in which the units are tight, the construction is informal, and the structural degradation is evident, which results in low perceived safety.

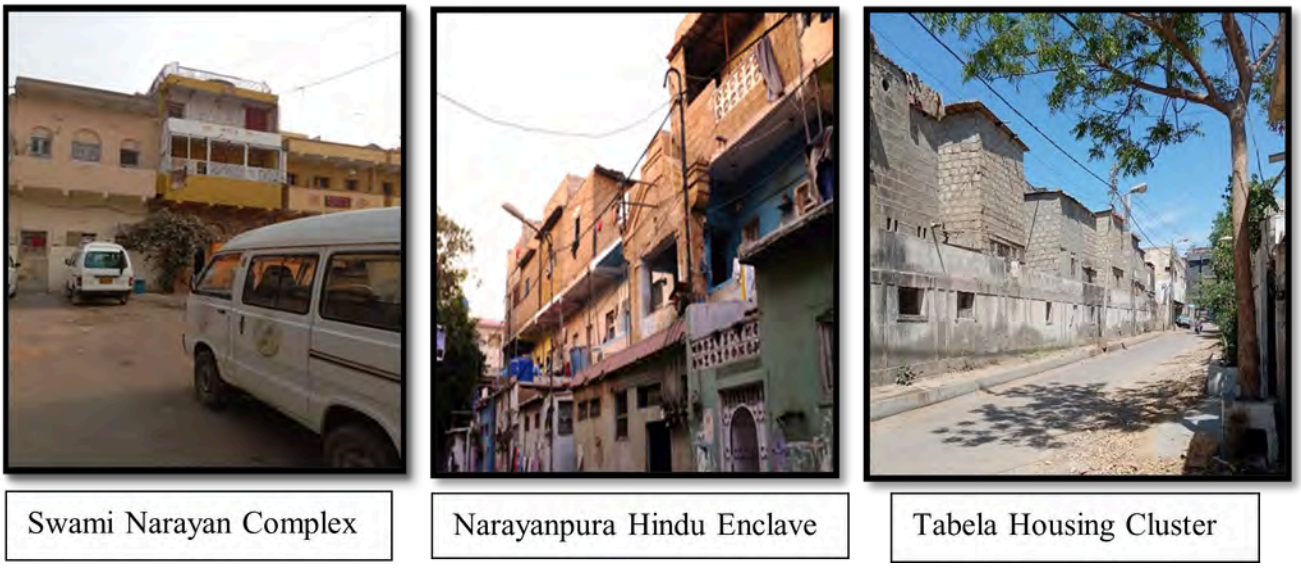
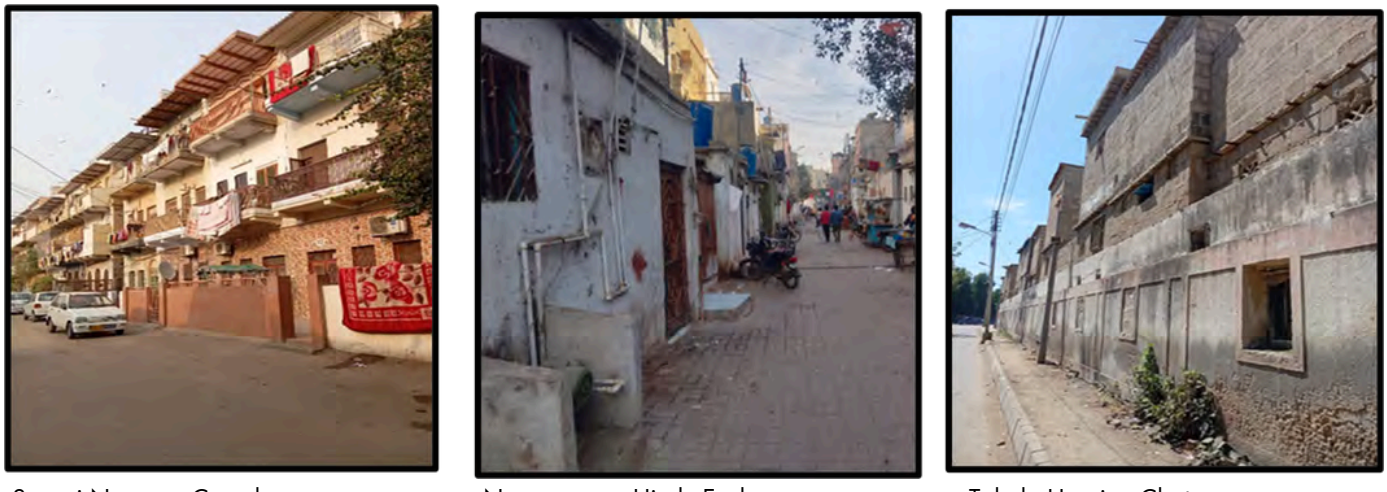


Figure 2: Building Form and structure of the three Hindu housing settlements under study

- **Construction Materials**

The Swami Narayan Complex has construction materials that are relatively long-lasting and have a roof of reinforced concrete, masonry of bricks, and finished surfaces, which contribute to an increase in longevity and ease of maintenance. Narayan Pura is mainly made of mixed materials: brick, stone, and recycled elements, which have an uneven lifespan and increased maintenance requirements. Tabela Housing is used very much the low-cost and temporary materials, which the residents feel are susceptible to weather and damage. Figure 3 presents a comparison of construction materials of the three Hindu settlements.



Swami Narayan Complex | Narayanpura Hindu Enclave | Tabela Housing Cluster

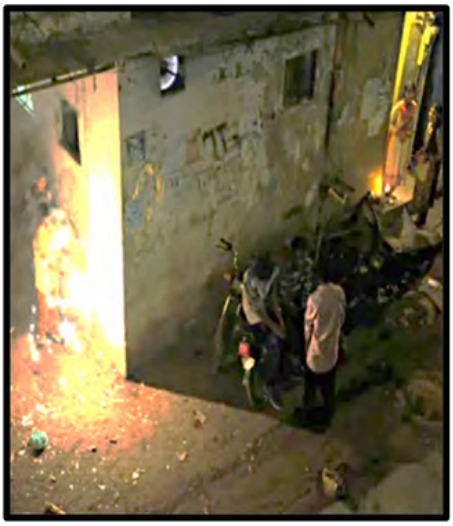
Figure 3: Construction Materials of the three Hindu housing settlements under study

- **Ventilation and Lighting**

The Swami Narayan Complex has the most favourable ventilation and daylight conditions because of setbacks that are planned, courtyards, and the location of windows. Narayan Pura has fluctuating ventilation, with the older units doing better than the densified ones that have been recently densified. Tabela Housing has a lack of airflow and sunlight because of poor airflow and narrow lanes. Figure 4 presents a comparison of ventilation and lighting of the three Hindu settlements.



Swami Narayan Complex



Narayanpura Hindu Enclave



Tabela Housing Cluster

Figure 4: Ventilation and Lighting of the three Hindu housing settlements under study

- **Façade & Visual Identity**

The Swami Narayan Complex has uniform facades, which encourage pride and visual unity and promote cultural identity. The exteriors of Narayan Pura are rather casual and customized with regard to cultural identity. Tabela Housing has minimal articulation of the facades and is ineffective in expressing the culture. Figure 5 presents a comparison of facade and visual continuity of the three Hindu settlements.



Swami Narayan Complex



Narayanpura Hindu Enclave



Tabela Housing Cluster

Figure 5: Facade and visual continuity of the three Hindu housing settlements under study

- **Environmental Adaptability**

The Swami Narayan Complex evidences planned structures, intra-courtyard planning, and controlled setbacks, which allow cross-ventilation and daylight to enter the buildings, as well as enable the greatest environmental flexibility. The use of shaded circulation spaces and open spaces surrounding the temple also increases microclimatic comfort and favours outdoor activities at various times during the day. Environmental adaptability in Narayan Pura is medium. The older housing units are usually built with some of the traditional climate-reactive designs, which include high ceilings, thick masonry walls, and internal openings that enhance thermal performance. The performance of the environment between streets and housing clusters is entirely different, due to the lack of plan coordination and the scope of environmental interventions related to collective activities. The Tabela Housing Cluster is characterized by the least environmental adaptability. Limited lanes and overboarded design exert more heat buildup and reduce drainage capacity during the monsoon seasons, and exposure to flooding and health hazards is augmented. Figure 6 presents a comparison of the environmental adaptability of the three Hindu settlements.



Swami Narayan Complex | Narayanpura Hindu Enclave | Tabela Housing Cluster

Figure 6: Environmental Adaptability of the three Hindu housing settlements under study

5.1.Comparative Housing Assessment through Spatial Indicators

- **Internal Space Configuration**

The Swami Narayan Temple Residential Complex has a well-structured internal space organization. Dwelling units are typically characterized by the presence of distinct living, sleeping, and service spaces, which enable the functional separation of activities and provide multi-generational families with sufficient privacy. The residents have greater satisfaction with room sizes and utilities. By contrast, the Narayan Pura Hindu enclave has a heterogeneous internal space structure. The old houses with courtyards and linear room planning are more flexible, whereas the recent infill extensions and vertical extensions have led to reduced room sizes and loss of privacy. The Tabela Housing Cluster exhibits the least organized arrangements, featuring one- or two-room units that incorporate various domestic functions, resulting in perceived overcrowding and conflicting functions. Figure 7 presents a comparison of the internal space configuration of the three Hindu settlements.



Swami Narayan Complex | Narayanpura Hindu Enclave | Tabela Housing Cluster

Figure 7: Internal space configuration of the three Hindu housing settlements under study

- **External Spatial Relationships**

It is in the Swami Narayan Complex that external spatial relationships are the strongest, where semi-private courtyards and open spaces of the temple area (marked in yellow on the layout plan) are used to foster social interaction and community activities. Narayan Pura depends on narrow streets and thresholds to create a social space; although they are good at creating social interaction, around the temple (marked in yellow on the layout plan), they are used excessively, making them uncomfortable. In Tabela Housing, there is a total lack of spaces outside the homes, and lanes can be used to facilitate passage, but not for socializing. There is an absence of social interaction spaces around the temple areas, as small temples are built inside the houses. Figure 8 presents a comparison of the external space relationships of the three Hindu settlements.



Swami Narayan Complex | Narayanpura Hindu Enclave | Tabela Housing Cluster

Figure 8: External space relationships of the three Hindu housing settlements under study

- **Circulation & Connectivity**

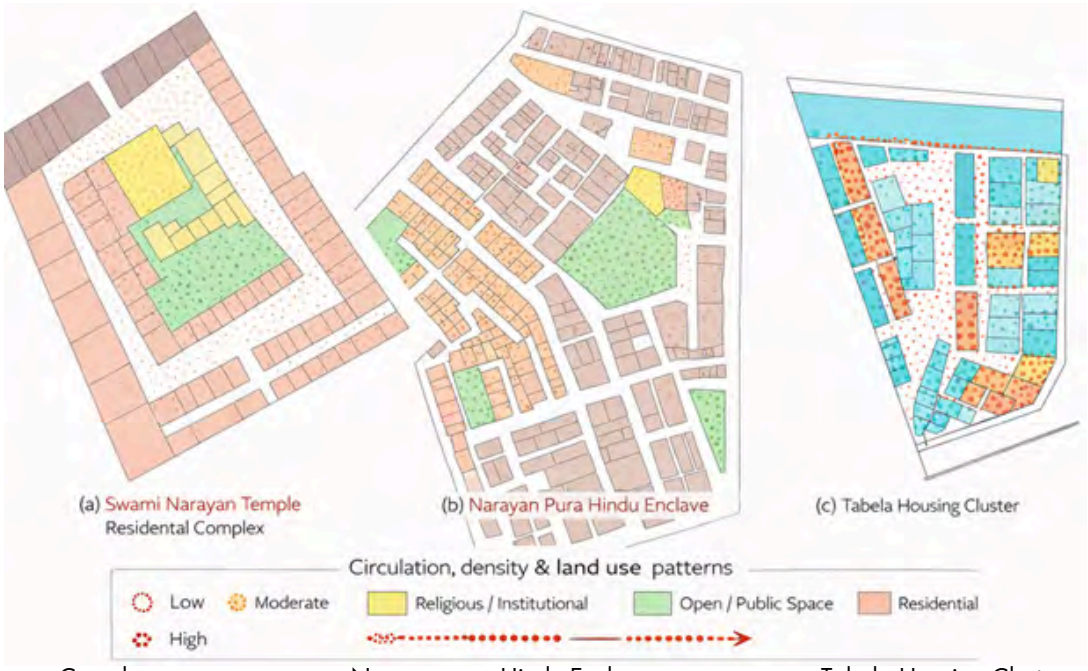
The Swami Narayan Complex is designed using a hierarchical and planned circulation pattern where the access routes are more general to allow unhindered movement of pedestrians and emergency access. The main access routes will lead the settlement to the roads, or nearby, and secondary and tertiary routes will lead to residential groups and inner yards, providing the possibility to move and access emergency. The circulation in Narayan Pura is typified by organic and fine-grained circulation. Small, reentrant streets create a complex grid system that puts more emphasis on people and socialization rather than efficiency. Although this layout is better than the previous one in terms of local connectivity and familiarity with the neighborhood, it restricts access to the location of cars and emergency services. Housing connectivity in Tabela Housing is a linear and fragmented one and has thin access paths and many dead ends. The mobility is extremely limited, and the absence of other routes decreases availability and security, particularly in the case of emergencies. Figure 9 presents a comparison of the circulation and connectivity of the three Hindu settlements.



Figure 9: Circulation and connectivity of the three Hindu housing settlements under study

- **Density & Land Use Pattern**

The Swami Narayan Complex is designed and structured at moderate density. The residential land use is mostly homogenous, whereas non-residential functions like the temple and the open space adjacent to it are clearly defined. Through this division and hierarchical arrangement of land uses it is possible to have enhanced spatial legibility, regulated density, and functional clarity. The density of Narayan Pura is very high, but naturally developed and hence due to extensions and subdivisions of the plot over the years. Non-residential land use and residential land use are extremely mixed with small temples, informal commerce, and community functions incorporated in the housing fabric. The density of the enclave differs in form spots of relative openness and highly congested spots. The Tabela Housing Cluster is a high residential density and low land-use differentiation. Housing occupies almost all the available land, leaving little room to communal, recreational or service purposes. This density is the most effective in terms of the shelter offer, but it hugely restricts the environmental comfort, safety, and flexibility. Figure 10 presents a comparison of the density and land use pattern of the three Hindu settlements.



Swami Narayan Complex Narayanpura Hindu Enclave Tabela Housing Cluster

Figure 10: Density and Land use pattern of the three Hindu housing settlements under study

- **Environmental Comfort & Safety**

The Swami Narayan Complex has a high concentration of high environmental comfort around the temple and central open spaces. This is an indication of improved access to daylight, ventilation, shaded courtyards, and thermal relief through premeditated setbacks and open spaces. Residential sides and inner blocks have a high level of continuity of the safety zones, which means a better view, their boundaries, and feelings of safety because of the institutional presence and restricted access. In Narayan Pura, environmental comfort is disjointed and disproportionately concentrated in pockets around the residual open spaces. Safety areas are more common but disjointed and are a reflection of dichotomous perception based on the narrowness of lanes, odd plotting, and irregular watch over them. In Tabela Housing, the amount of environmental comfort is limited and is confined to only some small pockets, which implies a lack of ventilation, shading, and exposure to heat as a result of extreme density. The map is mainly covered with safety areas, implying that residents should use social vigilance and familiarity to have security rather than the space or environmental design. Figure 11 presents a comparison of environmental comfort and safety of the three Hindu settlements.



Swami Narayan Complex Narayanpura Hindu Enclave Tabela Housing Cluster

Figure 11: Density and Land use pattern of the three Hindu housing settlements under study

5.2.Comparative Housing Quality Assessment of Socio-Cultural Indicators

- **Family Structure & Dynamics**

The Swami Narayan Temple Residential Complex hosts to a large extent, the stable nuclear and, to a certain degree, the extended families in purpose-built units providing ease in running the household and minimizing the domestic feuds. In the Narayan Pura Hindu enclave, the extended and multi-generational family is more typical and a representation of the close kinship relationships, but also a strain on household space. The Tabela Housing Cluster has the highest level of strain, with huge families living in very small units, further congesting them and limiting the privacy of the households.

- **Cultural Practices & Traditions**

The Swami Narayan Complex is the paramount place amongst the three housing settlements to embrace the cultural practices, as it is most visible and comfortable to have housing and shared facilities that conform to the religious calendars and common rituals. Narayan Pura promotes cultural practices by informally adjusting domestic and street spaces and showing cultural resilience amid space limitations. In Tabela Housing, the space and social vulnerability inhibit the normal application of cultural traditions. Figure 12 presents a comparison of the cultural practices and traditions of the three Hindu settlements.



Swami Narayan Complex | Narayanpura Hindu Enclave | Tabela Housing Cluster

Figure 12: Cultural practices and Traditions of the three Hindu housing settlements under study

- **Community Networks & Social Interaction**

Both the Swami Narayan Complex and Narayan Pura are strong in community networks, but they are different. The latter has the advantage of having community activities that are well organized around the temple, whereas Narayan Pura is based on established neighbourhood relationships and informal social interaction. Social networks are more survival-based and weaker in Tabela Housing as there is economic stress and residential instability. Figure 13 presents a comparison of community networks and social interaction of the three Hindu settlements.



Swami Narayan Complex | Narayanpura Hindu Enclave | Tabela Housing Cluster

Figure 13: Community Networks and social interaction of the three Hindu housing settlements under study

- **Identity & Cultural Continuity**

Residents of the Swami Narayan Complex express a strong sense of cultural security and identity visibility. Narayan Pura reflects a negotiated identity deeply rooted yet cautiously expressed. In contrast, Tabela residents often experience diminished cultural continuity, as only a few people decorate their homes minimally during festivals, due to insecurity and marginalization. Figure 14 presents a comparison of the identity and cultural continuity of the three Hindu settlements.



Swami Narayan Complex | Narayanpura Hindu Enclave | Tabela Housing Cluster

Figure 14: Identity and cultural continuity of the three Hindu housing settlements under study

- **Religious Needs and Spiritual Spaces**

The Swami Narayan Complex is highly institutionalized in the way it organizes religious practices, and the temple is a key spiritual, social, and temporal center. The prayers, celebrations, and joint ceremonies are all covered in special sacred areas, and this means that pressure on the house interiors is lessened. There is a lack of internal space in Narayan Pura that tends to spread day-to-day routine into semi-private entryways, streets, and communal courtyards, dismantling the distinction between the household and the world. Religious requirements are fulfilled by a combination of small shrines located in the neighbourhood, domestic shrines, and temporary ritual places established during festivals. Religious and spiritual activities in the Tabela Housing Cluster are mostly informal and homemade and usually restricted to small household temples or informal communal setups because of the lack of specialized religious facilities. Figure 15 presents a comparison of the religious needs and spiritual spaces of the three Hindu settlements.



Swami Narayan Complex | Narayanpura Hindu Enclave | Tabela Housing Cluster

Figure 15: Religious needs and Spiritual spaces of the three Hindu housing settlements under study

This section synthesizes and discusses the findings from the comparative housing assessment of the three Hindu settlements in Karachi. Drawing on the indicator framework developed in this study, five key points are highlighted to demonstrate how differences shape housing quality and lived experience across these settlements.

6.1. Planned versus Incremental Architectural Development

An architectural evaluation shows there is a vivid scale of planned to extremely informal development. The Swami Narayan Temple Residential Complex also reflects fairly consistent building designs, long-lasting construction materials, and harmonious fronts grounded in a core religious organization. This predetermined form helps to increase perceived architectural safety and visual unity. Contrarily, Narayan Pura employs the aspect of incremental and adaptive architectural development, where extension and vertical additions are made based on the needs of households, but they create structural anomalies and difficulties in their maintenance. The Tabela Housing Cluster has the weakest architectural conditions, using temporary materials, a small area unit, and open signs of wear, which further weakens the ability to endure the environmental and structural threats of residents. This comparison strongly reinforces the impact of planning and tenure security on the quality of architecture in the minority settlements.

6.2. Spatial Configuration, Density, and Functional Efficiency

The settlements can also be distinguished by spatial indicators. The Swami Narayan complex also has the advantage of a relatively balanced density, hierarchies of circulation, and internal courtyards which facilitate ventilation, accessibility, and movement in case of emergencies. Narayan Pura has a high-density organic spatial structure with narrow lanes and mixed land use that increase social interaction and deteriorate mobility and environmental comfort. The most restricted space configuration is that of Tabela, whereby there is high density, discontinuous circulation, and open space. In this case, circulation zones are frequently used in more than one way, making them more congested and less safe. These results demonstrate how marginalized settings are slowly made less space-efficient and livable through unchecked densification.

6.3. Socio-Cultural Continuity and Adaptive Use of Space

According to the socio-cultural indicators, there is high community resilience in all three settlements, but in different ways. The Swami Narayan Complex is formalized in areas of religious and communal practices, which increases collective identity and social unity. The socio-cultural practice in Narayan Pura is very adaptive, and the streets, the thresholds, and semi-private areas act as extensions of the domestic life and interaction among communities. In Tabela, socio-cultural life continues even in the presence of spatial deprivation, although there are no specific communal and religious spaces that restrict cultural manifestation and gender-spatial utilization. These trends indicate that the socio-cultural vitality tends to fill in the physical deficits but also requires the minimum spatial support.

7. CONCLUSIONS

This research shows that the housing assessment of the marginalized and minority groups, like the Hindu settlements in Karachi, has to go beyond the traditional and simple technical measurement of the quality of dwelling. The methodology embraced by incorporating architectural, spatial, and socio-cultural indicators and placing them within the framework of household, neighborhood, and political economy determinants directly contributed to the main goal of producing a holistic and context-sensitive perception of housing quality.
The methodology integrated field observations, spatial mapping, and the subjective perceptions of the residents, allowing the study to achieve much more than a lack of material elements, as the lived experiences of dignity, identity, and belonging that are seldom recorded in the housing standard metrics. The comparative evaluation framework, which was used in three different Hindu settlements at the Swami Narayan Temple Residential Complex, Narayan Pura Hindu Enclave, and Tabela Housing Cluster, was especially useful in demonstrating how differing levels of formality, institutional anchorages , and historical pathways affect housing results. Indicators were participatory and culturally sensitive, including the provision of religious space, gendered space use, and

community networks, ensuring that the evaluation was social but retained analytical rigor. This way, the methodology was a response to an important gap in the mainstream housing evaluation, which often under-represents culturally-specific needs, which are at the heart of the minority well-being.

On the whole, this study highlights the fact that housing assessment is not a diagnostic activity but a tactical criterion to inform inclusive urban policy. Housing assessments that are based on participatory and culturally sensitive approaches can add value to the resilience, social inclusion, and right to dignified living of marginalized communities in Karachi and similar urban settings.

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PAPER 3:

Mangrotha Gharbi – A Case Study: Reframing Architectural Pedagogy Beyond Affordable Housing in Flood-Prone Southern Punjab, Pakistan

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ABSTRACT

The 2022 floods in Pakistan displaced over 33 million people (Ministry of Planning, 2022), exposing the catastrophic inadequacy of conventional post-disaster architectural responses that privilege isolated housing objects over the territorial systems producing vulnerability. As part of the framework for Punjab Housing and Town Planning Authority's Conference discourse on "Beyond Affordable Housing," this paper argues that architectural responses to climate displacement must fundamentally pivot from object-oriented delivery to multi-scalar, territorial interventions. This research critically examines a fourth-year architectural design studio at COMSATS University Islamabad, Lahore Campus, which confronted the flood-ravaged settlement of Mangrotha Gharbi in Southern Punjab. Employing a research-by-design methodology grounded in analogue cadastral mapping, field immersion, and participatory surveys, the study asks: How can architectural pedagogy and urban practice be reframed through territorial inquiry to address climate vulnerability in the Global South? Key findings reveal that flood vulnerability is a politico-ecological condition shaped by infrastructural inequality, not merely natural exposure. Furthermore, community-embedded practices – such as communal hamiyari[1] labor networks and adaptive material strategies – constitute critical resilience resources excluded from formal design discourse. The paper concludes that alternative housing logics must emerge through decentralized communal infrastructure rather than rigid, isolated prototypes. Ultimately, this research contributes actionable insights for decentering Euro-American pedagogical models, offering a scalable blueprint for spatial justice, participatory resilience, and climate adaptation in peri-urban territories.

KEYWORDS:

Territorial pedagogy; spatial justice; climate resilience; alternative housing logics; participatory design; Global South; Southern Punjab

1. INTRODUCTION

The climate crisis has fundamentally destabilized the spatial and environmental conditions through which architecture and urbanism have traditionally operated. Across the Global South, accelerated urbanization, infrastructural fragmentation, and intensifying climate events have produced territories characterized by permanent precarity rather than stability (Roy, 2005); (Watson, 2009). Floods, droughts, and environmental displacement increasingly constitute ordinary conditions, not exceptional disruptions. Yet, dominant architectural paradigms continue to operate through epistemologies inherited from Euro-American modernism – frameworks developed within contexts of industrial stability that bear little relation to peri-urban realities. Standardized construction responses, which privilege the autonomous building over its ecological embeddedness, perpetuate risk rather than mitigate it.

[1] "Hamiyari" (cooperation, solidarity, or mutual aid) appears in contexts involving community-based recruitment, collaborative labour, or social support networks

Pakistan's 2022 floods exposed the catastrophic consequences of this epistemological disjuncture. Affecting over 33 million people and submerging approximately one-third of the country, the disaster revealed not only the immediate impacts of climate change but also the structural vulnerabilities deeply entrenched within land governance, spatial inequality, and material economies (Ministry of Planning, 2022). Peripheral and under-serviced settlements experienced disproportionate devastation, demonstrating that vulnerability is spatially produced through histories of neglect rather than being naturally distributed.

Directly addressing the overarching conference theme of the "Beyond Affordable Housing," organised by the Punjab Housing and Town Planning Authority, this paper posits that architectural and policy responses to climate displacement cannot be reduced to the mere provision of housing units. Addressing housing vulnerability requires territorial thinking – an approach that situates shelter within intersecting systems of ecology, infrastructure, governance, and community adaptation. To investigate this paradigm shift, the paper examines a fourth-year architectural design studio conducted at the Department of Architecture, COMSATS University Islamabad, Lahore Campus. The studio responded to the 2022 floods through sustained engagement with Mangrotha Gharbi, a flood-prone settlement near Taunsa Sharif in Southern Punjab.

The central research question driving this inquiry is: How can architectural pedagogy and urban practice be reframed through territorial inquiry to address climate vulnerability in the Global South? Three sub-questions guide the analysis: (1) How does flood vulnerability operate as a systemic and governance-linked territorial condition? (2) What alternative housing logics emerge from community knowledge and localized material practices? (3) How can design methodologies move beyond object-based aesthetics toward equitable territorial interventions?

The paper proceeds as follows: Section 2 reviews the theoretical framework encompassing decolonial critiques of architectural education and territorial theory. Section 3 details the studio's research-by-design methodology. Section 4 presents findings structured across governance, environmental, systemic, and equity dimensions, utilizing spatial data and design outputs. Section 5 discusses policy and design implications. Finally, Section 6 concludes with contributions to the field and future directions.

2. LITERATURE REVIEW / THEORETICAL FRAMEWORK

2.1 Key Debates: The Persistence of Object-Based Epistemologies

Architectural pedagogy and mainstream urban policy have historically been structured around the autonomy of the architectural object. Within conventional design culture and housing policy, buildings are treated as discrete formal entities, produced through processes of aesthetic control and quantitative delivery. Till (2009) critiques this disciplinary tendency, arguing that architecture persistently denies its dependence upon unstable social, political, and environmental conditions. The discipline's investment in formal resolution obscures the messy contingencies through which built environments are actually inhabited and produced.

This object-oriented epistemology becomes acutely problematic within contexts of environmental crisis. Conventional disaster-response frameworks frequently reduce climate resilience to the technical fortification of individual housing units, neglecting the larger ecological systems through which vulnerability emerges. As Davis and Alexander (2015) argue, long-term recovery depends less upon isolated housing prototypes than upon the restitution of social networks, communal infrastructures, and local adaptive capacities. Yet, within both architectural education and global "affordable housing" mandates, there remains a persistent bias toward delivering standardized aesthetic units over resolving infrastructural complexity.

2.2 Theoretical Positioning: Provincializing Planning in the Global South

Postcolonial urban theorists have vigorously challenged the universal claims embedded within dominant planning discourses. Chakrabarty's (2000) concept of "provincializing Europe" demands that Euro-American intellectual traditions be recognized as historically situated rather than universally applicable. Applied to architecture and urbanism, this requires questioning the assumption that Northern pedagogical models possess relevance across radically different socio-spatial contexts.

Roy (2005) critiques the exportation of planning frameworks—developed within contexts of formal urbanization—into territories characterized by informality and infrastructural fragmentation. Watson (2009) advocates for "seeing from the South," grounding planning theory within Southern urban realities rather than imposing external epistemologies. These critiques are exceptionally relevant in Pakistan, where architectural education continues to reproduce colonial institutional structures while remaining largely detached from environmental precarity (Hasan, 2020; Naeem, 2018). However, a decolonial approach must also acknowledge that territorial, multi-scalar thinking already exists within South Asian vernacular traditions. Systems such as barani (rain-fed) agriculture, kacha/pakka hybrid construction, and community-based water management possess an embedded ecological logic that long predates modernist frameworks (Hussain, 2025).

2.3 Conceptual Definitions: Territory, Infrastructure, and Housing Logics

The theoretical pivot from "object" to "territory" draws upon scholarship reconceptualizing the built environment as relational. Allen (1999) conceptualizes "field conditions" to propose an architecture concerned with systemic flows and interactions rather than isolated boundaries. Similarly, Easterling (2014)defines "infrastructure space" as the invisible matrix through which spatial power and vulnerability operate. These frameworks destabilize traditional scalar hierarchies, demanding that shelter be analyzed within interconnected ecological and governance systems.
Crucially, these infrastructural concepts resonate with established theories of alternative housing. Turner's (1976) foundational proposition of "housing as a verb" rather than a noun, the incremental housing paradigms documented by Hamdi (2004), and the Orangi Pilot Project's participatory sanitation models in Karachi (Hasan, 2006) all demonstrate housing logics grounded in community agency and territorial negotiation. In these models, shelter is not a delivered commodity but a systemic process.

2.4 Spatial Justice and the Identified Gap

The concept of spatial justice provides the necessary critical lens for understanding uneven disaster impacts. Soja (2010), Cutter (1996), and Wisner et al. (2004) argue that vulnerability is fundamentally spatialized: exposure to climate hazards is dictated by histories of uneven development, material poverty, and infrastructural marginalization. In this view, vulnerability is actively produced by governance failures rather than naturally occurring.
Identified Gap: While extensive literature addresses participatory housing and post-disaster recovery as isolated domains, a critical gap remains at the intersection of pedagogy and policy. Few empirical studies examine how architectural education itself can be structurally reorganized to produce practitioners capable of territorial, justice-oriented practice in flood-prone Global South contexts. This research addresses that gap by demonstrating how an epistemological shift in the design studio can generate alternative, systemic housing logics applicable to broader urban policy.

3. METHODOLOGY: STUDIO AS TERRITORIAL INQUIRY

3.1 Research Design

The investigation adopted a mixed-methods, "research-by-design" methodology, positioning the academic design studio as a vehicle for territorial inquiry and participatory action research. Conducted during the Fall 2022 semester at COMSATS University Islamabad, Lahore Campus, the studio involved 24 fourth-year architecture students divided into four collaborative research units. Over 16 weeks – anchored by an intensive five-day field immersion in the flood-affected settlement of Mangrotha Gharbi – the studio operated as an active research laboratory testing the shift from object-based design to systemic urban intervention.

3.2 The Recursive Multi-Scalar Framework

Challenging the linear production of architectural objects, the studio developed a replicable, three-phase recursive framework for urban investigation:

- Phase 1: Macro-Systems (Weeks 1–5): Non-site-specific investigations into regional hydrology, landscape ecology, and historical disaster risk management across Pakistan.
- Phase 2: Meso-Immersion (Weeks 6–9): On-site field engagement emphasizing situated observation and participatory data validation over extractive documentation.
- Phase 3: Micro-to-Macro Recursion (Weeks 10–16): Design development that forced students to operate simultaneously across scales – linking regional hydrology to community infrastructure and localized housing adaptation.

3.3 Study Area: Mangrotha Gharbi

Mangrotha Gharbi lies at the interface of Taunsa city's municipal boundary and the agrarian floodplain extending west toward the Koh-e-Suleiman foothills (Figure 1). The site's micro-topography makes it a funnel for flash floods descending through the Sanghar nullah. In 2022, the settlement was struck by torrents from both upstream breaches and backflow from the Indus floodplain — a dual hazard rarely accounted for in local planning. The area encompasses approximately 17 hectares, with 259 mapped structures and an estimated population of 1,250 residents, primarily daily-wage laborers and agricultural workers.

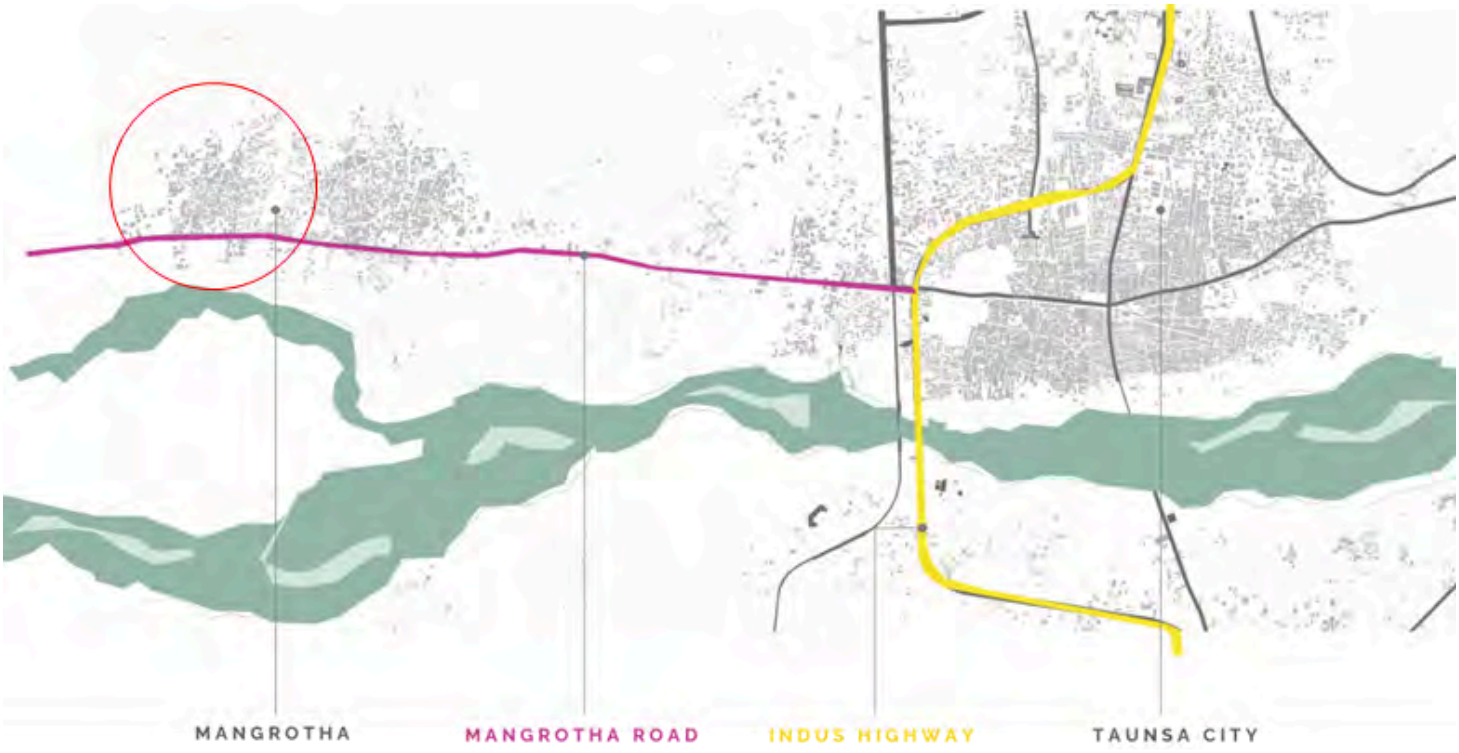


Figure 1 Aerial overview of Mangrotha Gharbi adjacent to Taunsa Sharif, with the Sanghar stream nearby. The red outline marks the core study area used for field mapping and overlays; Source: From "Mangrotha Gharbi: Towards Integrated Strategies for Resilient Housing and Communal Growth" by N. A. Saad, S. Shuja, G. Husnain, and 4th year Architecture student body, 2022, COMSATS University, Lahore, Pakistan. Copyright 2022 by COMSATS University. Reprinted with permission

3.4 Data Sources, Tools, and Techniques

To bridge the gap between technical planning and lived realities, the studio employed a combination of qualitative and spatial data collection methods:

- **Household Surveys:** Structured questionnaires were conducted with 67 households (representing 32% of the settlement) to extract quantitative data on demographics, construction typologies, and infrastructural access.



Figure 2. Participatory verification session utilizing analogue cadastral overlays to map flood corridors with community residents. Source: From "Mangrotha Gharbi: Towards Integrated Strategies for Resilient Housing and Communal Growth" by N. A. Saad, S. Shuja, G. Husnain, and 4th year Architecture student body, 2022, COMSATS University, Lahore, Pakistan. Copyright 2022 by COMSATS University. Reprinted with permission

- **Analogue Cadastral Mapping:** Avoiding the exclusionary nature of highly technical GIS software, the studio utilized analogue mapping with transparent overlays. This deliberate choice enabled participatory verification sessions, allowing residents to visually interpret and validate flood corridor mapping and damage assessments.

Three primary datasets were compiled:

1. **Cadastral Base Maps:** Produced manually through on-site measurement, compass alignment, and visual triangulation with existing cadastral sheets. Each parcel and structure footprint was recorded at 1:500 scale.
2. **Building Condition Surveys:** 259 structures were catalogued using a uniform form capturing materials, roof type, plinth level, number of storeys, and damage level (Not Damaged, Partially Damaged, Completely Damaged, Rebuilt).
3. **Household and Health Surveys:** 67 households were visually documented, and data was collected on household construction composition and sanitation facilities.

The manually prepared cadastres were digitised and overlaid using transparent sheets — a low-technology yet precise approach that allowed multiple variables, inclusive of surveyed community input, to be compared visually. Each overlay represented one of the following datasets:
Each overlay represented one of the following datasets:

- Topography and Drainage Channels and macro, meso and micro levels, derived from ground-level elevation readings (see figures 3, 4 & 5)
- Construction Material Typology (see figure 7)
- Damage Category (see figure 7.1)

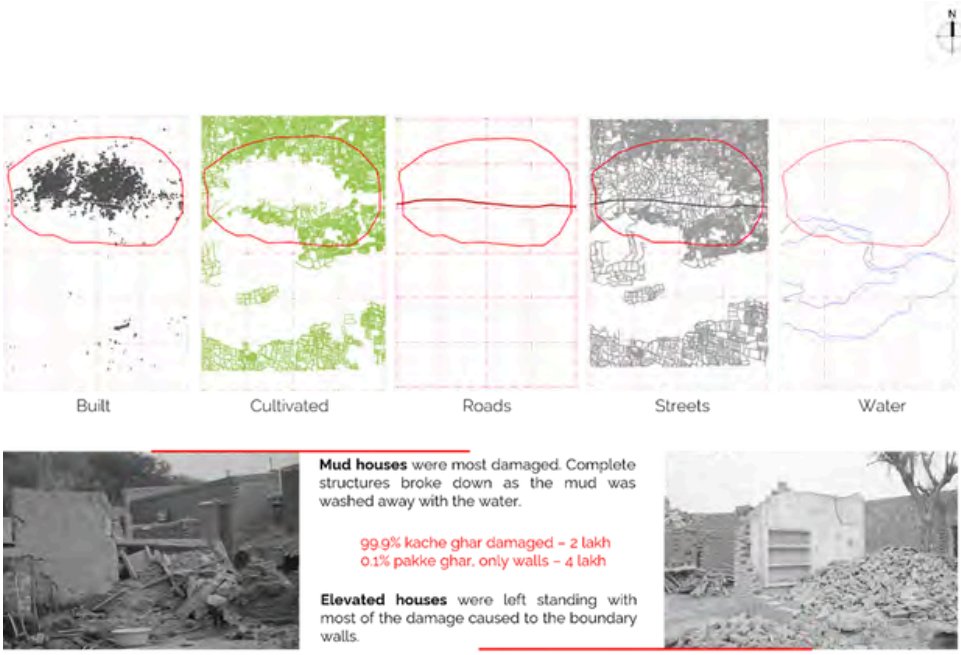


Figure 3. Composite overlay mapping of terrain identification and damage assessment; Source: From "Mangrotha Gharbi: Towards Integrated Strategies for Resilient Housing and Communal Growth" by N. A. Saad, S. Shuja, G. Husnain, and 4th year Architecture student body, 2022, COMSATS University, Lahore, Pakistan. Copyright 2022 by COMSATS University. Reprinted with permission

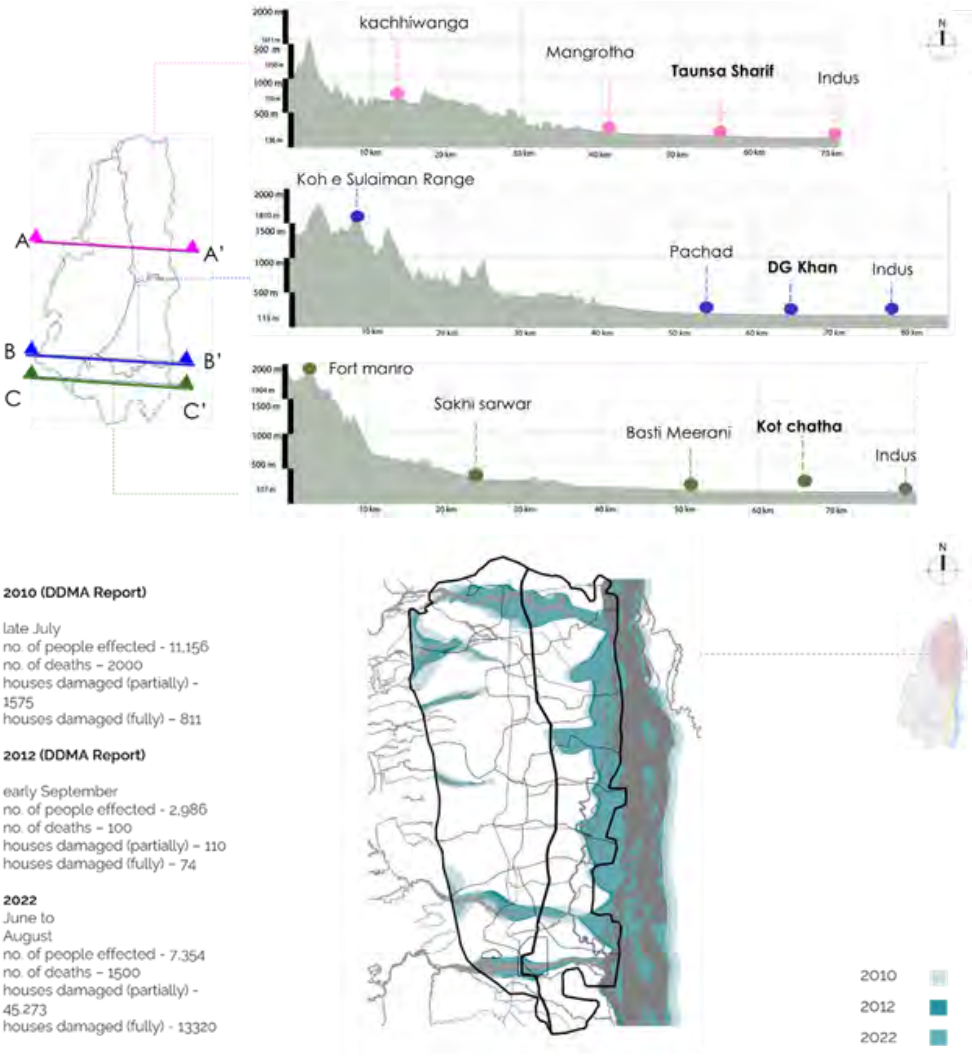


Figure 4. Composite overlay mapping of topography, damage levels, and torrential flood occurrences at macroscale throughout the years; Source: From "Mangrotha Gharbi: Towards Integrated Strategies for Resilient Housing and Communal Growth" by N. A. Saad, S. Shuja, G. Husnain, and 4th year Architecture student body, 2022, COMSATS University, Lahore, Pakistan. Copyright 2022 by COMSATS University. Reprinted with permission

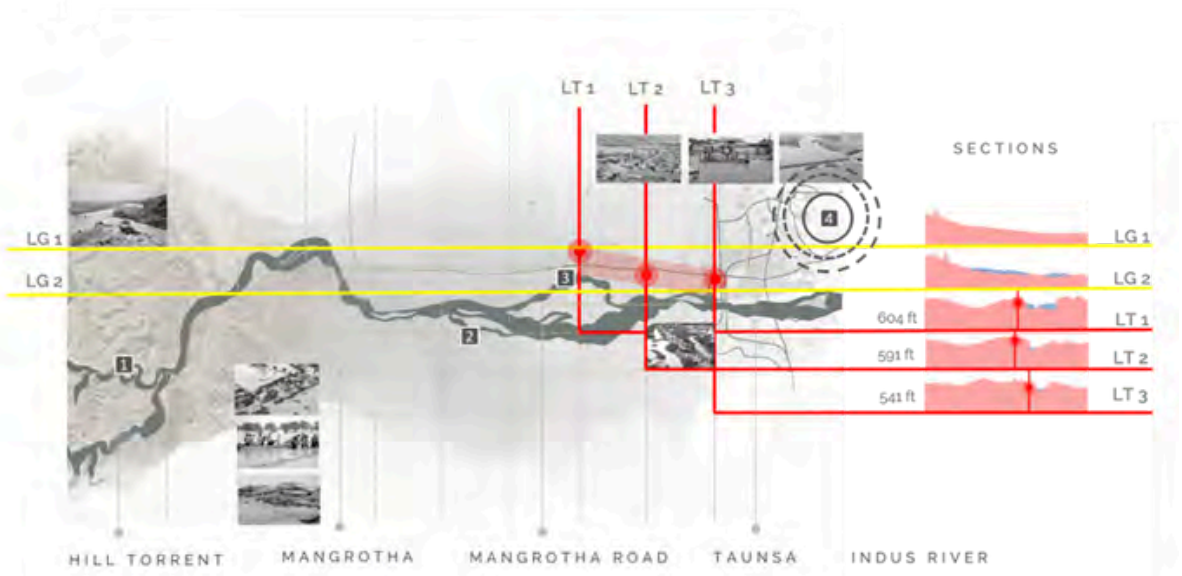


Figure 5. Composite overlay of topography, damage levels and torrential flood occurrences throughout the years at the meso scale; Source: From "Mangrotha Gharbi: Towards Integrated Strategies for Resilient Housing and Communal Growth" by N. A. Saad, S. Shuja, G. Husnain, and 4th year Architecture student body, 2022, COMSATS University, Lahore, Pakistan. Copyright 2022 by COMSATS University. Reprinted with permission

This analogue approach offered key advantages compared to standardized processes such as GIS mapping. It enabled direct engagement with local government bodies in map verification sessions. It produced a visually intuitive representation of vulnerability that could be used for local decision-making—a strength often lacking in highly technical GIS outputs.

- Participatory Interviews: Semi-structured interviews with 12 key informants (including community elders, women, and local masons) gathered qualitative data on informal adaptation practices and historical flood knowledge.



Figure 6. Students documenting on-site reconstruction practices, observing material reuse and adaptive strategies employed by residents following the 2022 floods. Source: From "Mangrotha Gharbi: Towards Integrated Strategies for Resilient Housing and Communal Growth" by N. A. Saad, S. Shuja, G. Husnain, and 4th year Architecture student body, 2022, COMSATS University, Lahore, Pakistan. Copyright 2022 by COMSATS University. Reprinted with permission

- **Transect Walks:** Systematic cross-settlement routes were mapped to document the material economies and the condition of communal infrastructure.

3.5 Ethical Considerations and Limitations

Given the acute post-disaster context, ethical protocols were rigorously maintained. Verbal informed consent was secured from all participating households, accommodating the settlement's literacy demographics, and the university's institutional review board approved the methodology. To prevent extractive research practices, all spatial data and surveys were made available for sharing with the local government when requested. Furthermore, the studio abstained from providing direct individual compensation to avoid distorting local socio-economic dynamics; instead, collective contributions were encouraged to be made privately by the students, at their own behest, towards an organisation of their own choosing working towards flood relief.
Methodological limitations included the semester's abbreviated duration, which constrained longitudinal engagement. Additionally, language barriers (academic discourse is conducted in English, but the local languages spoken are Saraiki, Urdu and Punjabi) necessitated local intermediaries as well as a dual language survey (English and Urdu), which may have filtered qualitative nuances. Pedagogically, the methodology encountered initial friction: approximately 20% of the student cohort exhibited resistance to the delayed production of architectural objects. However, this friction ultimately proved productive, requiring intensive desk critiques that successfully transitioned the students toward systemic design thinking.

4. ANALYSIS / FINDINGS: TERRITORIAL VULNERABILITY AND ALTERNATIVE HOUSING LOGICS

The findings from the Mangrotha Gharbi studio demonstrate that climate vulnerability cannot be resolved through the isolated delivery of architectural objects. When students were forced to delay building design and instead map the settlement territorially, a fundamentally different understanding of disaster risk emerged. The subsequent analysis categorizes these findings across four intersecting dimensions of urban resilience: climate/environmental, policy/governance, technological/systemic, and social/spatial equity.

4.1 Climate / Environmental: Flooding as a Topographical and Territorial Condition

Conventional disaster recovery models frequently treat flooding as a singular, unpredictable atmospheric event, resulting in generic housing prototypes designed to withstand arbitrary water levels. However, the studio's analogue cadastral overlays revealed that flooding in Mangrotha Gharbi operated as a highly specific, localized territorial condition.
Spatial mapping identified a four-foot (1.2m) topographical depression running through the western sector of the settlement. This depression functioned as an invisible flood corridor during heavy monsoon rains, concentrating hydrological flows and violently intensifying structural destruction. By mapping building collapse against topographical gradients, the studio proved that environmental exposure was fundamentally uneven. Furthermore, participatory transect walks revealed deep reserves of embedded ecological knowledge among the residents. Community members possessed a granular understanding of seasonal water flows and soil saturation limits, developed through repeated exposure to five major flood events since 1988.

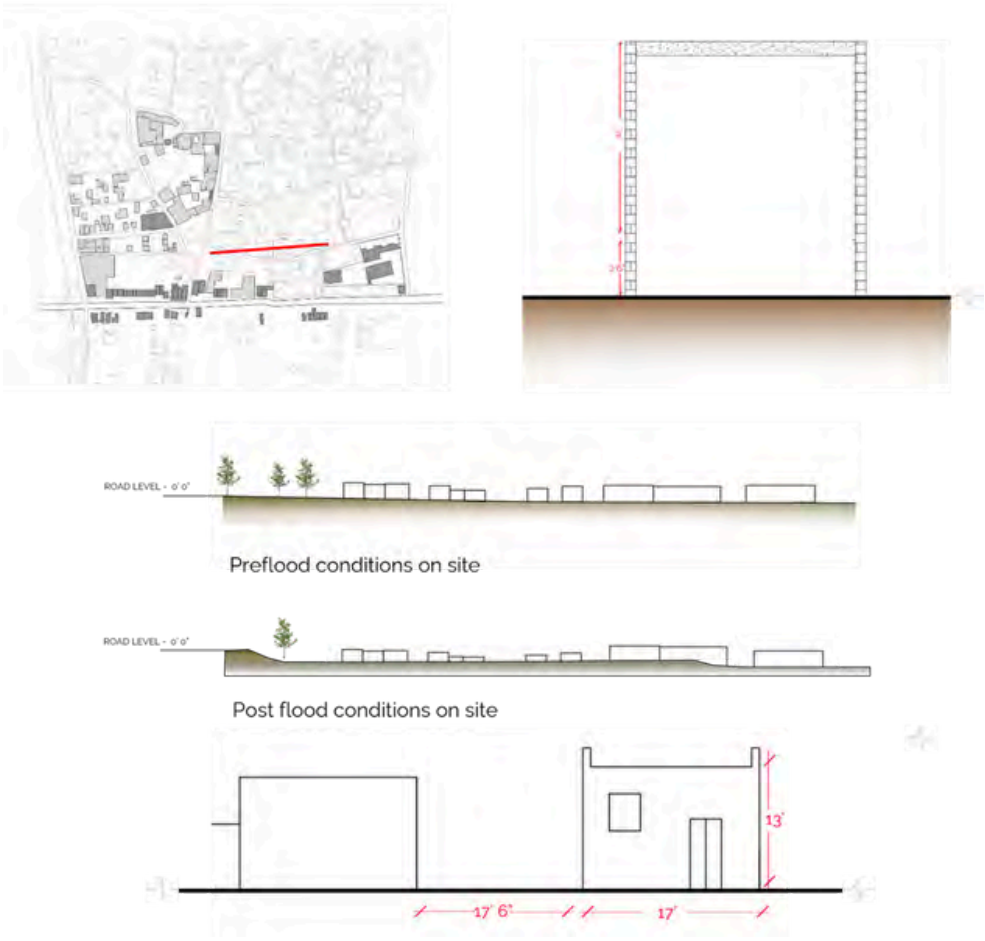


Figure 7 Sectional sketch showing elevation gradient across the western depression. The lowest contours align with the densest clusters of destroyed mud-brick homes; Source: From "Mangrotha Gharbi: Towards Integrated Strategies for Resilient Housing and Communal Growth" by N. A. Saad, S. Shuja, G. Husnain, and 4th year Architecture student body, 2022, COMSATS University, Lahore, Pakistan. Copyright 2022 by COMSATS University. Reprinted with permission

The depression's alignment with unpaved access lanes amplified the velocity of floodwaters, transforming them into channels of concentrated force. The landform, unacknowledged in formal planning documents, had long been occupied by the poorest households—those unable to afford plots on higher ground. Thus, the geography of the settlement directly translated into a geography of loss, affirming White's (2010) principle that "floods reveal the social landscape more clearly than the hydrological one."

4.2. Material Fragility and Structural Hierarchies

The building survey revealed three dominant typologies:

1. **Kache Ghar (sun-dried/mud bricks construction):** Representing 64% of total structures, these were built from sun-dried bricks with minimal plinths. All but 8 of these houses were either destroyed or rendered uninhabitable.
2. **Semi-Pakke Ghar (baked - brick masonry with mud mortar):** Roughly 23% of structures, sustaining partial but repairable damage.
3. **Pakke Ghar (Brick and Cement Construction):** Only 13%, concentrated near the elevated road. Most remained standing.

This stratification mirrors income levels and land tenure security. The complete overlap between the mud-construction layer and the complete-damage layer in the overlays visually confirmed the material economy of vulnerability. Residents of the "kache ghar" cluster also reported the highest incidence of displacement and loss of household assets, as seen in figures 8(a) and 8(b).

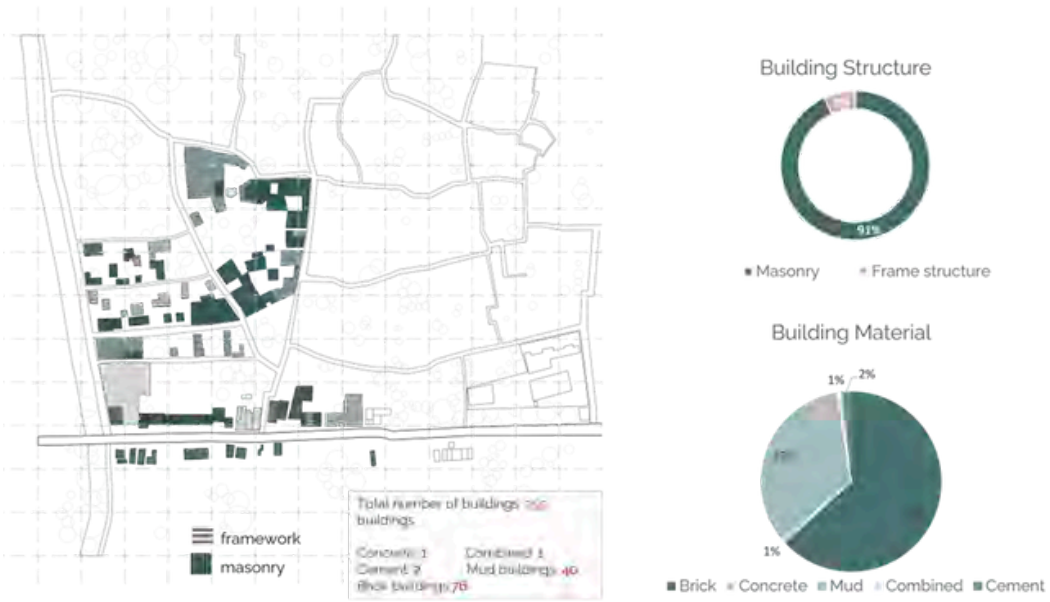


Figure 8 (a). Material-damage correlation map 1. Overlay of building materials; Source: From "Mangrotha Gharbi: Towards Integrated Strategies for Resilient Housing and Communal Growth" by N. A. Saad, S. Shuja, G. Husnain, and 4th year Architecture student body, 2022, COMSATS University, Lahore, Pakistan. Copyright 2022 by COMSATS University. Reprinted with permission.

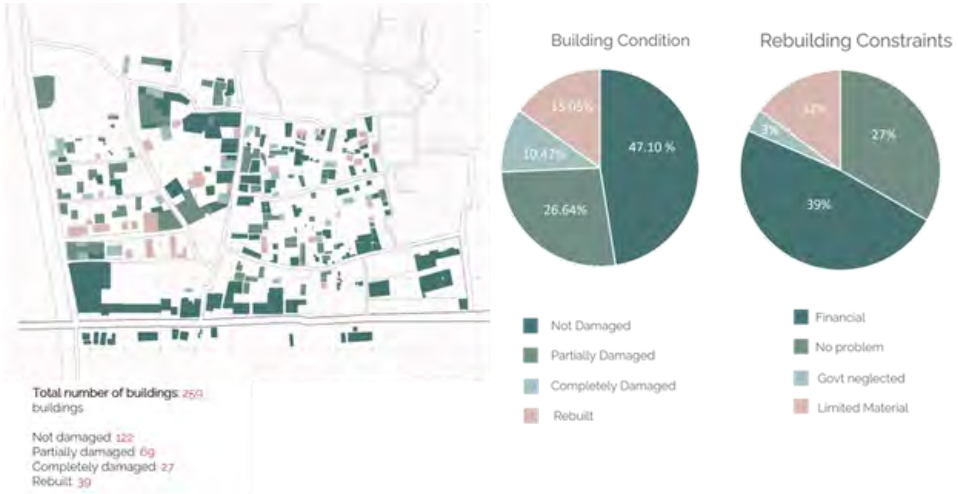


Figure 8 (b) Material-damage correlation map 2, highlighting overlay of structural damage categories; Source: From "Mangrotha Gharbi: A Case Study" by N. A. Saad, S. Shuja, G. Husnain, and 4th year Architecture student body, 2022, COMSATS University, Lahore, Pakistan. Copyright 2022 by COMSATS University. Reprinted with permission

Both diagrams (Figures 8a and 8b) show a significant collapse of "kache ghar," revealing a direct spatial correlation between economic status and destruction.

This localized environmental data starkly contrasted with standardized, national-level flood risk maps, which lacked the micro-topographical resolution required to predict exact community impacts. From an architectural and urban planning perspective, these findings underscore that environmental resilience cannot be achieved by designing a "waterproof" house; it must be achieved by designing with the hydrological terrain, utilizing ecological buffers such as vegetative berms and swales to redirect water flows before they reach domestic boundaries.

4.3 Policy / Governance: Manufactured Vulnerability and Infrastructural Neglect

The studio's territorial inquiry critically dismantled the narrative of the "natural" disaster, revealing how vulnerability in Mangrotha Gharbi was actively manufactured through governance failures and unregulated industrial activity (Wisner et al,. 2004). While the maintenance of hills-torrents in the Koh -e- Suleimani mountain

was a large part of the structural failure that caused flooding, during participatory interviews, residents consistently pointed to a nearby illegally erected commercial stone-crushing plant as one of the potential primary catalysts for the unprecedented 2022 water levels.

Spatial analysis confirmed that the plant's unregulated tailings and ad-hoc infrastructural earthworks had severely altered upstream drainage patterns, as seen in figure 9. By blocking historical runoff routes, these industrial interventions redirected high-velocity floodwaters directly into the settlement's western depression. Crucially, official post-disaster needs assessments and formal hydrological reports failed to document this anthropogenic factor, attributing the destruction solely to climate-induced rainfall (Ministry of Planning, 2022).



Figure 9. Diagrammatic mapping of anthropogenic flood intensification, illustrating how unregulated industrial tailings altered upstream drainage patterns into the settlement. Source: From "Mangrotha Gharbi: A Case Study" by N. A. Saad, S. Shuja, G. Husnain, and 4th year Architecture student body, 2022, COMSATS University, Lahore, Pakistan. Copyright 2022 by COMSATS University. Reprinted with permission

This represents a profound policy and governance failure. When state apparatuses and technocratic planning bodies ignore the politico-ecological realities of a territory, they inadvertently subsidize the destruction of peripheral settlements. The studio findings demonstrate that urban policy cannot treat affordable housing as a vacuum; housing policy must be integrated with strict regional land-use governance and industrial regulation. Building a structurally sound house downstream of an unregulated, drainage-altering industrial site is a futile exercise in resilience.

4.4 Technological / Systemic: Beyond the Standardized Architectural Object

A core finding of the research was the inadequacy of standardized technological interventions in post-disaster contexts. Formal reconstruction programs often rely on imported, rigid structural configurations – such as standardized MS (mild steel) beam roofing systems or universal concrete block prototypes. The studio's analysis of structural failure rates challenged this reliance on rigid objectification.

Data extracted from the household surveys correlated construction typologies directly with collapse rates. Kacha (mud-brick and thatch) structures suffered an 89% collapse rate, while semi-pukka (brick walls with corrugated roofing) experienced a 47% failure rate. However, rather than concluding that all housing must be replaced with highly engineered pukka (reinforced concrete) structures – which is both economically unfeasible and ecologically damaging – the studio documented sophisticated, localized technological adaptations.

Residents engaged in incremental, systemic modifications. For example, 78% of reconstructed homes utilized elevated plinths, raising floor levels by 2-3 feet using compacted earth and salvaged brick. Others actively rejected rigid structural elements that proved lethal during collapses, pivoting toward hybrid roofing techniques - similar to filler slab methodologies - that optimize thermal mass while reducing dead load and catastrophic failure risks.

Based on these systemic insights, the studio's design outputs deliberately resisted the single "affordable house."

Instead, students proposed decentralized, technological systems: clustered housing arrangements around shared raised courtyards, phased material improvement plans, and elevated composting toilets to replace the unlined pit latrines that had been constructed immediately after locals returned to their homes. These proposals represent an alternative housing logic – one where technology is applied systemically across communal infrastructure rather than concentrated in a single, isolated dwelling unit.

4.5 Social / Spatial Equity: The Hamiyari System and Distributing Risk

Finally, the research frames climate vulnerability as a crisis of spatial justice (Soja, 2010). The topographical mapping of Mangrotha Gharbi revealed a direct correlation between spatial geography and economic marginalization. The most hazardous zones within the flood corridor were predominantly occupied by landless laborers utilizing kacha construction, whereas salaried or remittance-dependent households occupied elevated, secure terrains with pukka construction (12% collapse rate). Material fragility operated as the physical manifestation of economic inequality.

However, within this landscape of spatial inequity, the studio identified robust social infrastructures of resilience. The most critical discovery was the prevalence of the hamiyari system – a localized practice of rotating, communal labor-sharing among extended kinship networks. Following the floods, 91% of surveyed households relied on hamiyari networks to clear debris, elevate plinths, and rebuild shelters.

Traditional object-based housing policies, which emphasize individualized property ownership and nuclear-family delivery models, actively fracture these communal labor networks. By treating housing as an individualized commodity, formal recovery programs isolate vulnerable populations from their primary mechanism of resilience. In response, the studio's concluding design outputs integrated the hamiyari system directly into the architectural programming. Student proposals conceptualized housing not as private assets, but as interdependent clusters sharing elevated platforms and water filtration systems. This social/spatial approach distributes climate risk across a communal network, proving that true equity in post-disaster contexts is achieved not through the delivery of equal objects, but through the reinforcement of cooperative social systems.

5. DISCUSSION: REFRAMING POLICY AND PEDAGOGY

5.1 Critical Interpretation of Findings

The findings from the Mangrotha Gharbi studio emphatically validate the theoretical proposition that architectural and urban resilience cannot be achieved through the autonomous building object. By shifting the pedagogical focus from "object" to "territory," the research demonstrated that climate vulnerability in peri-urban Pakistan is an infrastructural and governance condition, not merely an environmental one. The discovery of the unregulated stone-crushing plant – and its direct role in redirecting floodwaters into the settlement's topographical depression —perfectly illustrates Easterling's (2014) concept of "infrastructure space," where hidden spatial power and unregulated interventions actively manufacture disaster at the peripheries.

Furthermore, the studio's documentation of the hamiyari system and localized technological adaptations (such as elevated plinths and hybrid roofing) extends Turner's (1976) foundational concept of "housing as a verb" into the era of acute climate crisis. It confirms that marginalized communities already possess sophisticated, adaptive housing logics. The failure of post-disaster recovery does not stem from a lack of community capacity, but from formal planning systems that refuse to "see from the South" (Watson, 2009). By prioritizing standardized, universalized housing units, formal urban policies actively overwrite and dismantle these existing networks of resilience.

5.2 Policy and Design Implications

To move "Beyond Affordable Housing," national and global disaster management frameworks must undergo a paradigm shift in how recovery funds are allocated. Currently, entities like Pakistan's National Disaster Management Authority (NDMA) and international NGOs focus heavily on delivering standardized "core shelters."

The findings of this studio suggest a fundamentally different policy approach: state and NGO resources should be redirected away from the individual architectural object and toward communal, territorial infrastructure, as devised in a proposal developed by a group of students in figure 10.

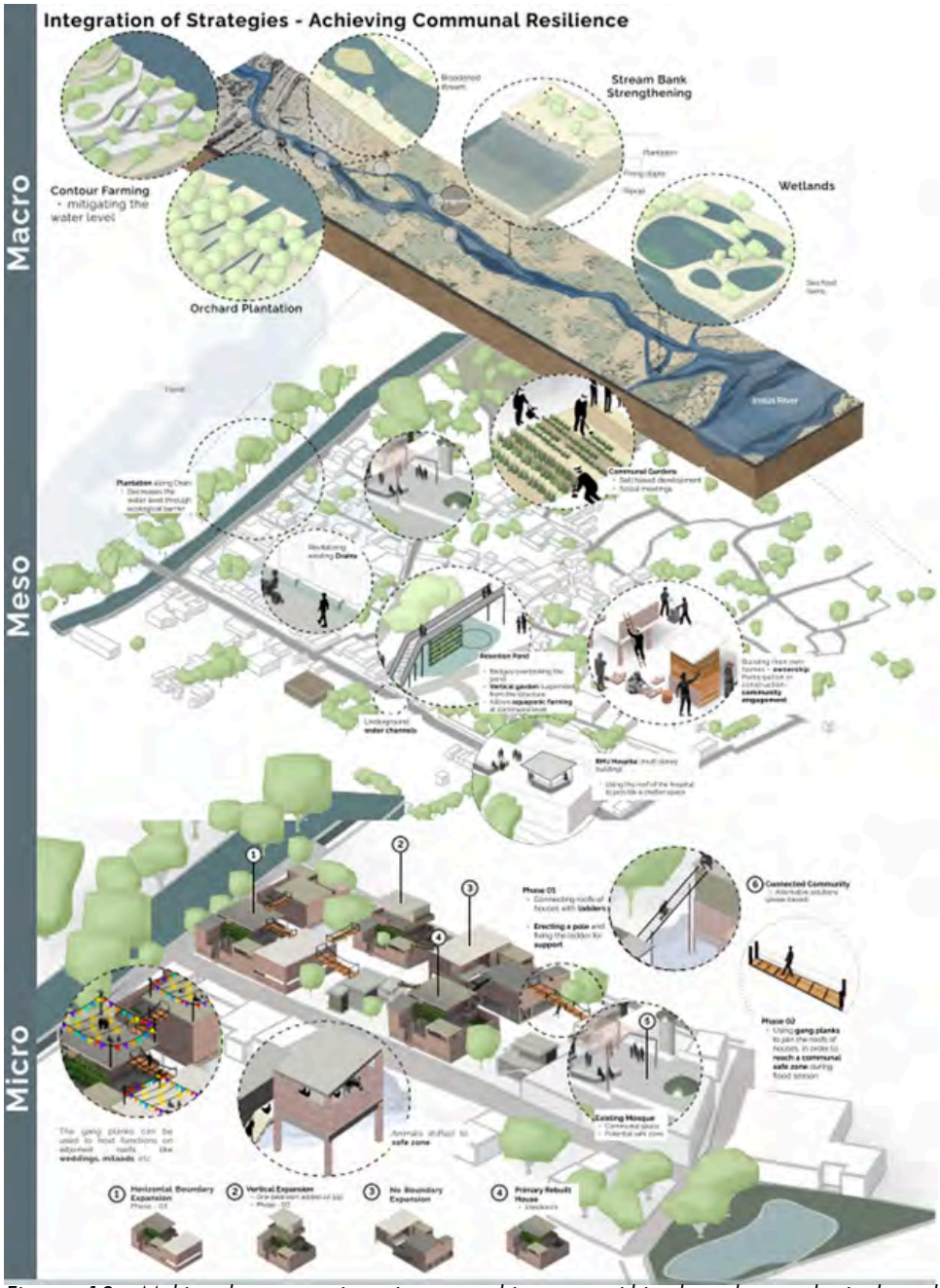


Figure 10. Multi-scalar strategies situate architecture within broader ecological and infrastructural systems. The design framework links mitigation strategies for regional flood dynamics to localized housing models through networks of shared space and collective adaptation. Source: From "Mangrotha Gharbi: A Case Study" by N. A. Saad, S. Shuja, G. Husnain, and 4th year Architecture student body, 2022, COMSATS University, Lahore, Pakistan. Copyright 2022 by COMSATS University. Reprinted with permission

If vulnerability is spatialized (Soja, 2010), then policy interventions must also be spatial. Rather than providing rigid MS beam roofs or concrete blocks to isolated households, governance bodies should fund the macro-level site grading of flood corridors, the construction of decentralized, elevated community platforms, and shared sanitation infrastructures. Once the territorial and infrastructural baseline is secured, the community's embedded hamiyari networks can incrementally manage the construction of the domestic envelope, utilizing localized, climate-responsive material adaptations.

5.3 Broader Relevance for Architectural Pedagogy

The pedagogical friction experienced during the studio – specifically, student resistance to delaying object production – highlights a deep disciplinary crisis. If architectural education continues to define success through the aesthetic resolution of the isolated building (Till, 2009), it will continue to produce practitioners fundamentally

unequipped to operate in the climate-destabilized realities of the Global South. The multi-scalar, analogue methodology tested at COMSATS University Islamabad, Lahore Campus, offers a scalable blueprint. By integrating participatory action research as a core studio requirement, academic institutions can bridge the widening gap between architectural education, urban policy, and climate justice.

6. CONCLUSION

The 2022 floods in Pakistan exposed not only the fragility of the built environment but also the epistemological inadequacy of object-based architectural and planning paradigms.

This paper has demonstrated that climate displacement cannot be solved by simply designing better, cheaper houses. Shelter in the Global South must be reconceptualized as a multi-scalar, territorial system.

Returning to the central research question – How can architectural pedagogy and urban practice be reframed through territorial inquiry? – This study concludes three key points. First, environmental vulnerability is an actively manufactured condition requiring systemic governance solutions, not isolated architectural prototypes. Second, true resilience lies in communal social infrastructures, such as the hamiyari network, which must be integrated into, rather than replaced by, formal planning policies. Third, architectural pedagogy can be successfully reframed by replacing linear, object-oriented design sequences with recursive, participatory methods like analogue cadastral mapping, forcing practitioners to confront the infrastructural realities of the territory.

This paper contributes to the fields of spatial justice, decolonial urbanism, and architectural education by providing an empirically grounded, Global South methodology that provincializes Euro-American pedagogical models. Future directions for this research include the longitudinal tracking of graduate cohorts to assess whether territorial pedagogy ultimately alters their professional practice, as well as comparative, multi-scalar studios across other highly vulnerable, flood-prone geographies such as Sindh and Balochistan.

Ultimately, the challenge facing global urban policy and architectural education is not merely technological, but fundamentally epistemological: we must transform how we see, analyse, and intervene in the world.

ACKNOWLEDGEMENTS

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TABLE OF FIGURES

Fig. No	Title	Description
1	Aerial Overview of Mangrotha Gharbi	Settlement boundary and positional context between Taunsa Sharif and Sanghar stream.
2	Participatory verification session	Students utilizing analogue cadastral overlays to map flood corridors with community residents
3	Composite overlay mapping of terrain identification and damage assessment	Manual overlay showing correlation between terrain and destruction at a meso and micro scale
4	Composite overlay mapping of topography, damage levels, and torrential flood occurrences throughout the years	Manual overlay showing correlation between terrain and historical flood levels at a macroscale
5	Composite overlay of topography, damage levels and torrential flood occurrences throughout the years at the meso scale	Regional and local context map of Mangrotha Gharbi, Southern Punjab, indicating the settlement's proximity to the Taunsa Sharif flood corridor.
6	Students documenting on-site reconstruction practices, observing material reuse and adaptive strategies employed by residents following the 2022 floods	Students observed localized reconstruction practices and engaged with masons to understand the limitations and constraints of their methodologies.
7	Sectional sketch showing elevation gradient across the western depression	Cross-section highlighting a 4-foot depression and destruction corridor.
8(a)	Material-damage correlation map 1	Overlay of building materials in use prior to flooding.
8(b)	Material-damage correlation map 2	Overlay of structural damage categories
9	Diagrammatic mapping of anthropogenic flood intensification	The mapping illustrates how unregulated industrial tailings altered upstream drainage patterns into the settlement.
10	Multi-scalar strategies situate architecture within broader ecological and infrastructural systems	The design framework links mitigation strategies for regional flood dynamics to localized housing models through networks of shared space and collective adaptation.

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PANEL 4

HOUSING BEYOND SHELTER: SOCIAL EQUITY, INCLUSION, AND EVERYDAY LIFE

Nabah A. Saad[1], Sara Aqeel[2], Maryam Siddiq[3], Samina Mussrat Islam[4]

1.Assistant Professor, Comsats University (Moderator)
2.Deputy Director Engineering/Projects, PHATA
3. Assistant Professor, UET, Lahore
4. Consultant ADB&WB

This panel discussion focused on housing beyond affordability, examining how questions of social equity, gender, informality, livelihood, and accessibility continue to shape the realities of housing in Pakistan. Moderated by Nabah Saad, the discussion brought together perspectives from government institutions, international development practice, and academia to critically reflect on the limitations of conventional affordable housing models. Rather than treating affordability simply as the reduction of housing costs, the discussion repeatedly emphasized that housing must also respond to social realities, informal economies, gendered experiences, mobility patterns, and community life. Across the session, the panelists argued that many formal housing schemes fail not because housing is unavailable, but because the systems being produced remain disconnected from how people actually live and work.

Nabah Saad opened the discussion by framing affordability as only one dimension of the housing question. She emphasized that the conversation needed to move beyond numerical calculations of unit cost and instead focus on housing through the lens of lived realities, social equity, and inclusion. Through her opening questions, she positioned the session around understanding how affordable housing policies often fail to account for the everyday social, cultural, and economic realities of the communities they intend to serve. Her moderation consistently pushed the discussion toward examining the disconnect between state-led housing models and the lived experiences of marginalized groups, particularly women, informal workers, and lower-income communities.

The first major discussion focused on what "housing beyond affordability" actually means when viewed through social equity and lived realities. Responding from the perspective of PHATA, Sara Aqeel explained that affordability alone cannot solve the housing crisis because social inclusion itself remains one of the biggest challenges within state-led housing systems. According to her, one standard solution cannot be applied across all of Punjab because communities possess different cultural practices, lifestyles, and social expectations. She argued that affordable housing must therefore become culturally responsive and socially adaptive rather than relying on uniform planning approaches.

She discussed how PHATA is currently revising policies, regulations, and planning standards to move toward more inclusive housing frameworks. Referring to the revision of the national housing policy and the draft policies prepared for 2025, she emphasized that current institutional discussions increasingly recognize the importance of social environments, cultural inclusion, and accessibility within affordable housing schemes. At the same time, she acknowledged the practical difficulties faced by PHATA, particularly the shortage of state-owned land within urban centres. According to her, because land within city centres is expensive and limited, state agencies are increasingly being pushed toward vertical housing and incremental housing systems instead of conventional low-rise developments. She also reflected on the challenge of balancing affordability with access to employment opportunities and commercial centres, emphasizing that housing disconnected from workplaces and urban services ultimately becomes unsustainable for residents.

Expanding the conversation beyond physical housing provision, Samina Musarrat Islam reflected on the social dimensions of resettlement, participation, and community life within housing schemes. Drawing from her extensive experience with the Asian Development Bank and the World Bank, she argued that architects and engineers often remain disconnected from the social realities of the populations they are designing for. According to her, housing schemes are frequently planned without understanding who the future residents are, how they previously lived, what kinds of social networks they relied upon, or how they accessed employment, healthcare, education, transportation, and community support systems.

She emphasized that profiling communities before relocation or resettlement is essential because without understanding existing living conditions, housing schemes cannot respond meaningfully to people's social and economic realities. In particular, she stressed that women's experiences are often ignored within housing policy and planning processes. According to her, women's lives in informal settlements and semi-urban areas are deeply connected to social networks, informal labour systems, local support structures, and neighbourhood familiarity. When communities are relocated into formal housing schemes, these social systems frequently collapse. Women lose access to informal employment opportunities, community support systems, and familiar social environments while simultaneously facing new mobility restrictions and security concerns.

She discussed how women living in low-income settlements often work informally as domestic workers, industrial labourers, agricultural processors, or home-based workers. However, once relocated into planned housing societies located far from workplaces and urban centres, many women lose these livelihood opportunities entirely. She also reflected on how social isolation becomes a major issue within newly developed housing schemes. In informal settlements, women often rely on neighbourhood relationships, informal childcare arrangements, local healthcare advice, and social familiarity. In contrast, newly developed housing societies frequently lack community spaces, social cohesion, and trusted support systems.

Another issue she emphasized was mobility and safety. According to her, women entering unfamiliar housing environments often experience restrictions on movement because of concerns related to harassment, insecurity, poor lighting, and weak public infrastructure. She discussed how even basic urban systems such as waste collection, street lighting, schools, markets, and transportation become gendered concerns because women are usually responsible for household management, childcare, and domestic mobility. If waste disposal points are located too far away, women avoid using them. If streets are poorly lit, women hesitate to move outside after dark. If schools and markets are inaccessible, women bear the burden of travelling longer distances while managing domestic responsibilities. For her, equitable housing therefore requires much more than physical shelter; it requires the rebuilding of social networks, community support systems, and gender-sensitive infrastructures that enable women to participate safely and confidently within urban life.

The discussion then moved toward informality and the inability of formal housing systems to accommodate populations working outside formal economic structures. Nabah Saad asked why formal housing models consistently fail to address informal practices and informal communities. Responding to this, Maryam Siddique argued that most affordable housing systems are designed around assumptions of formal employment, fixed incomes, and measurable financial stability. According to her, state-led affordable housing schemes generally target populations who can demonstrate stable incomes, qualify for loans, or fit within standardized financial frameworks. However, large sections of Pakistani society function through informal economies, irregular incomes, shared housing arrangements, and non-standardized employment structures.

She emphasized that women, in particular, often operate within highly informal labour systems that remain invisible within formal housing policies. Domestic workers, home-based labourers, and informal sector workers frequently lack the documentation or financial histories required to access conventional housing schemes. According to her, when affordable housing systems exclude populations working outside formal economic structures, they fail to address the realities of the communities most in need of housing support. She argued that the first step toward more equitable housing systems is acknowledging the existence and importance of these informal populations rather than continuing to design policies only for lower-middle-class formal workers.

The conversation later shifted toward scalability and the limitations of large-scale housing models. Nabah Saad raised questions about how large housing schemes often fail to address gendered and community-specific needs once implemented at scale. Responding to this, Samina Musarrat Islam expanded on the social disruptions caused by relocation into formal housing societies. She explained that women's lives are deeply structured around proximity to workplaces, social familiarity, childcare arrangements, and local support systems. When housing schemes are developed in peripheral locations far from urban centres, residents may technically receive housing but simultaneously lose access to jobs, transportation, schools, markets, and social support networks.

According to her, planned housing societies often assume that housing itself is sufficient, while ignoring the larger ecosystem of daily life. Women who previously participated in neighbourhood-based economies or informal labour systems become isolated and economically dependent once relocated.

She argued that affordable housing must therefore be linked directly with livelihood opportunities, transportation systems, healthcare facilities, educational access, and social infrastructure. Community centres, women's gathering spaces, childcare facilities, and safe public environments become essential components of equitable housing systems rather than optional additions.

The discussion also connected strongly with broader concerns regarding climate resilience and preparedness. Igor reflected on how housing systems must increasingly prepare for future environmental and climate-related disruptions. Drawing from his work within humanitarian and resilience contexts, he argued that climate-related hazards such as floods, water scarcity, and environmental disasters will continue intensifying globally and particularly within countries such as Pakistan. According to him, preparing housing systems for the future requires integrated planning approaches that strengthen not only housing itself but also infrastructure systems, livelihoods, utilities, and social safety nets.

He emphasized that climate resilience cannot be addressed through isolated housing interventions alone. Instead, housing must be connected to electricity systems, water systems, transportation, social protection mechanisms, and employment structures capable of functioning during crises. He referred to Pakistan's evolving adaptive social protection systems as important examples of how social safety nets can become climate responsive by supporting communities living in disaster-prone areas. According to him, resilience requires work across multiple scales simultaneously—from housing and infrastructure to governance systems and economic security.

Another important point he emphasized was the importance of maintaining a humane perspective within technical planning discussions. Although policy conversations frequently refer to human-centred design and sustainability, he argued that planning processes often lose sight of the everyday realities and vulnerabilities experienced by communities themselves. In his view, sustainable housing depends not only on technological systems or engineering solutions but on creating systems that communities understand, trust, maintain, and participate in collectively. For him, resilience ultimately depends on strengthening relationships between housing, services, livelihoods, and community support systems so that settlements remain functional during both ordinary and crisis conditions.

The session later expanded into broader research presentations that further complicated the relationship between affordability, sustainability, ecology, and infrastructure. Zahid Nawaz Ajam and Sikandar Ajam presented the idea of housing as ecological infrastructure rather than isolated units or products. Their presentation argued that conventional housing development in Pakistan prioritizes maximizing density and minimizing construction costs while ignoring long-term lifecycle performance, environmental systems, and community wellbeing. According to them, this model creates housing that may appear affordable initially but becomes increasingly unaffordable because of transportation costs, energy inefficiencies, infrastructural burdens, environmental exposure, and weak community systems.

They proposed an alternative ecological model of affordability in which housing is understood as part of interconnected environmental, social, and infrastructural systems. Their proposal emphasized walkability, blue-green infrastructure, productive landscapes, pedestrian networks, water recycling, biodiversity, community spaces, and incremental growth models. Instead of organizing settlements around plots and roads alone, they argued for designing housing through environmental systems such as hydrology, wind patterns, shading networks, and shared public spaces. According to them, affordability should not be measured simply through unit cost but through long-term social, environmental, and infrastructural performance.

Ramsha Rehman extended this conversation through her research on socio-spatial equity and service-linked tenure housing. She argued that Pakistan's affordable housing crisis is not only a matter of supply shortages but also a mismatch between what housing policies produce and what low-income communities actually need. Through surveys and case studies, she demonstrated that many low-income populations prioritize workplace proximity, job security, communal systems, and flexible instalment structures over conventional remote plot-based housing schemes. She emphasized that many affordable housing projects fail because they are located far from workplaces, impose unrealistic financial burdens, and ignore the everyday economic realities of urban poor communities.

Her proposal focused on service-linked housing models where housing is directly connected with employment opportunities and payroll-based instalment systems. She also argued for more integrated housing schemes that

combine different income groups within shared developments rather than isolating low-income communities in separate peripheral clusters. According to her, affordability must be understood through accessibility, livelihood security, and social inclusion rather than only through land prices or plot dimensions.

As the session progressed, the discussion increasingly reframed housing as a multidimensional social system rather than a purely architectural or financial product. Across the panel and subsequent presentations, affordability emerged as inseparable from livelihood, gender, mobility, accessibility, ecological systems, climate resilience, and community life. The conversation repeatedly emphasized that equitable housing requires moving beyond standardized housing units and toward integrated systems capable of supporting the social, economic, environmental, and cultural realities of the people who inhabit them.

CONCLUDING REFLECTIONS: FUTURE DIRECTIONS FOR HOUSING AND URBAN DEVELOPMENT

Dr. Mamuna Iqbal[1]

1.Assistant Professor, UET, Lahore, VP-Women in Architecture Pakistan

The conversations, papers, and discussions presented throughout this conference collectively demonstrate that the future of housing and urban development in Pakistan cannot be addressed through isolated interventions, disciplinary silos, or short-term solutions. Across the panels, paper presentations, and thematic sessions, a shared realization emerged: housing is not merely an architectural product or a question of affordability, but a deeply interconnected social, environmental, infrastructural, economic, and political condition that shapes how people live, move, work, and imagine their futures.

The conference brought together policymakers, architects, planners, researchers, development practitioners, academics, and students through a structure that intentionally connected critical dialogue with research-based inquiry. Alongside the panel discussions, the conference also included paper presentation sessions organized around four central themes: Reframing Governance: Policy, Regulation and Institutional Reform; Technological and Systemic Innovation in Housing Delivery; Climate Responsive Housing and Resilient Built Forms; and Equity, Culture and Alternative Housing Logics. Together, these themes created a framework through which housing could be examined not only as a technical problem, but as a complex urban system embedded within wider questions of governance, ecology, social justice, and resilience.

The first thematic track, Reframing Governance: Policy, Regulation and Institutional Reform, highlighted that the housing crisis in Pakistan is fundamentally linked to governance fragmentation, institutional disconnects, and the separation of housing from larger urban systems such as transport, infrastructure, and livelihoods. Papers presented within this session demonstrated how existing housing policies often fail because they isolate affordability from accessibility and socio-spatial realities. Discussions around transit-oriented development in Lahore, informal densification in Peshawar, and service-linked tenure systems collectively emphasized that the central issue is not simply affordability itself, but the mismatch between housing, employment, mobility, and urban opportunity. The session repeatedly stressed that fragmented policy structures and weak coordination between institutions continue to undermine implementation processes. Participants argued for integrated and equity-driven housing models that connect housing with transport systems, social infrastructure, and community participation while moving beyond exclusionary and standardized approaches toward more inclusive urban development frameworks.

The second thematic track, Technological and Systemic Innovation in Housing Delivery, shifted the conversation toward questions of technology, ecological systems, construction processes, and infrastructural transformation. Rather than focusing narrowly on isolated technologies, the papers emphasized the need for integrated systems-based approaches to housing delivery. Presentations explored ecological models of affordability, decentralized greywater reuse systems in peri-urban Lahore, and BIM-based frameworks for sustainable low-carbon construction. Across these discussions, a central concern emerged: contemporary housing systems remain technically inefficient, environmentally unsustainable, and excessively dependent on outdated plot-based development models and centralized infrastructure systems. The papers demonstrated that sustainable and low-cost alternatives already exist, including decentralized infrastructure systems, passive environmental strategies, indigenous materials, and ecological planning approaches. However, barriers such as policy limitations, institutional resistance, lack of technical support, and limited implementation mechanisms continue to prevent these innovations from being scaled effectively. The discussions ultimately argued that future housing delivery systems must become decentralized, resource-efficient, environmentally responsive, and capable of integrating technology, infrastructure, planning, and community needs into cohesive systems.

vulnerability, and resilient urban futures. The papers and discussions within this track emphasized that climate responsiveness cannot be reduced to isolated technological interventions or superficial environmental strategies. Instead, resilience must emerge through integrated planning systems rooted in local knowledge, vernacular practices, material intelligence, and ecological awareness. Presentations on sustainable built environment models, climate resilience in architecture and design, and comparative analyses of vernacular and modern housing typologies demonstrated that traditional spatial systems and local material practices often outperform contemporary construction methods in terms of thermal comfort and environmental adaptation.

At the same time, the session highlighted that building performance depends on the integration of multiple variables—including orientation, ventilation, spatial configuration, material behaviour, and urban microclimates—rather than singular interventions. Importantly, resilience was framed not only at the scale of individual housing units but at the neighbourhood and urban scale, requiring integrated planning of mobility systems, streets, ecological infrastructure, and environmental networks. Across the session, there was a strong consensus that future housing systems must move toward passive, low-energy, and climate-sensitive design approaches capable of reducing dependence on mechanical systems while improving environmental sustainability and long-term resilience.

The fourth thematic track, Equity, Culture and Alternative Housing Logics, expanded the discussion further by critically questioning the assumptions underpinning conventional formal housing systems. Papers within this session explored issues of spatial inequality, incremental growth, flood resilience, community participation, and housing quality within marginalized settlements. Discussions around optionality and density, flood-resilient community design in Mangrotha Gharbi, and housing quality assessment frameworks for marginalized communities collectively emphasized that housing inequity is fundamentally spatial and systemic rather than simply financial.

A recurring concern across the session was that formal housing models frequently fail because they ignore lived realities, cultural practices, informal economies, and social networks that shape how communities actually inhabit space. Participants argued that informality and incremental development are not temporary failures of urbanization but central components of how many communities survive and adapt within conditions of limited resources and institutional neglect. The session therefore emphasized the importance of participatory, community-driven, and context-sensitive approaches that engage users directly within planning and implementation processes. Alternative housing logics—including cooperative systems, incremental housing models, hybrid formal–informal systems, and community-led development—were presented not as marginal experiments but as viable and scalable pathways toward more inclusive and adaptable housing futures.

Across all four themes, several interconnected concerns repeatedly surfaced. Climate resilience emerged not only as an environmental issue, but as a social, infrastructural, and governance challenge deeply connected to questions of housing, mobility, water systems, livelihoods, and ecological degradation. Similarly, affordability consistently appeared as inseparable from accessibility, transportation, employment opportunities, and social inclusion. The conference repeatedly demonstrated that housing cannot be understood independently from broader urban systems and everyday life.

Another important contribution of the conference was its emphasis on implementation. While many discussions acknowledged the existence of policies, pilot programmes, technological innovations, and institutional frameworks, there was also widespread recognition that implementation gaps remain one of the greatest challenges within Pakistan's urban and housing sectors. The conference therefore repeatedly returned to the need for stronger institutional coordination, interdisciplinary collaboration, evidence-based policymaking, and long-term planning systems capable of translating ideas into scalable and sustained interventions.

At the same time, the conference also revealed that many valuable solutions already exist in fragmented forms across different disciplines, communities, and institutional practices. Lessons are emerging from vernacular architecture, climate adaptation initiatives, ecological planning systems, housing finance models, decentralized infrastructures, and participatory planning practices. The challenge moving forward is not simply to produce more isolated projects, but to connect, strengthen, and scale these efforts while remaining attentive to local realities and social contexts.

Ultimately, the conference reinforced the understanding that the future of Pakistani cities depends upon our collective ability to rethink development itself. Sustainable and equitable urban futures cannot emerge through environmentally disconnected planning, socially exclusionary housing systems, fragmented governance, or purely market-driven development models. They require collaborative approaches that place resilience, ecological responsibility, accessibility, social justice, and human dignity at the centre of planning and housing processes.

This booklet therefore serves not only as a record of the conference proceedings, but as part of an ongoing conversation about the future of housing and urbanism in Pakistan. The discussions, papers, and reflections presented here point toward the need for continued collaboration between government institutions, academic researchers, practitioners, development agencies, and communities themselves. More importantly, they demonstrate that housing must ultimately be understood not simply as the provision of shelter, but as the creation of environments capable of sustaining life, opportunity, resilience, and collective futures.

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Dr. Mamuna

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