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AFFORDABLE HOUSING AS A CATALYST FOR URBAN REGENERATION: MICRO-LEVEL EVIDENCE FROM SMART CITY REDEVELOPMENT IN TUMAKURU, INDIA

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ABSTRACT

Affordable housing in Indian cities is increasingly influenced by welfare imperatives and pressures related to land scarcity, urban regeneration, and municipal finance. This study investigates affordable housing as both a tool for social transformation and a mechanism for urban land regeneration, using a micro-level case study of the Mariammanagar Affordable Housing Project under the Tumakuru Smart City Mission in Karnataka, India. The research adopts a convergent mixed-methods approach, using primary survey data from 24 beneficiary households, qualitative interviews, focus group discussions, and secondary data from municipal and Smart City project records. Quantitative analysis uses a Housing Quality Index (HQI) and a Social Well-being Index (SWI), with paired t-tests and nonparametric tests to evaluate pre- and post-intervention outcomes. The findings indicate statistically significant improvements in housing quality, health, dignity, and neighbourhood cohesion, along with notable reductions in social conflict. In addition to household-level benefits, the project enables the recovery of high-value, centrally located urban land through vertical redevelopment, thereby facilitating land monetization and enhancing long-term municipal revenue capacity. The study concludes that affordable housing, when integrated with smart city governance and land-based financing frameworks, can serve as a strategic mechanism for inclusive urban regeneration in medium-sized Indian cities.

Keywords: *Affordable housing[1], Smart Cities Mission[2], Housing Quality Index[3], Land Regeneration[4], Land value capture[5], India[6].*

1. INTRODUCTION

India's post-independence urbanisation has proceeded rapidly, unevenly, and often without adequate regulation, leading to the widespread emergence of informal settlements. After the 1947 Partition and subsequent economic

centralisation, Indian cities became primary destinations for rural-to-urban migrants, placing sustained pressure on infrastructure and planned land use. Slums, defined by high population density, substandard housing, and limited access to essential services such as sanitation and potable water, became the principal housing option for a significant portion of the urban workforce, especially for households in the Economically Weaker Sections (EWS). State responses to slums have historically shifted from clearance and eradication policies that regarded informal settlements as urban blight to a more nuanced understanding of their socio-economic roles within the urban system. However, the primary policy challenge remains balancing the protection of housing security and human rights for slum residents with the need for planned urban development and efficient land use, particularly in high-value central urban areas.

1.1 Government of India Initiatives for Slum Relocation and Rehabilitation

To address the scale and persistence of urban informality, the Government of India has implemented several significant housing programmes over recent decades, reflecting a gradual transition from coercive measures to developmental and rights-based strategies. Initial policies that focused on peripheral relocation frequently disrupted livelihoods and social networks, thereby intensifying urban poverty. Subsequent programmes aimed to address these deficiencies. The Jawaharlal Nehru National Urban Renewal Mission (JNNURM), particularly its Basic Services to the Urban Poor (BSUP) component, and the later Rajiv Awas Yojana (RAY), institutionalised in-situ redevelopment by enhancing housing and service delivery without displacing residents. The current flagship initiative, Pradhan Mantri Awas Yojana–Urban (PMAY-U), has further formalised this approach through four distinct verticals and explicitly encouraged technological innovation and private-sector involvement to reduce the urban housing deficit. The in-situ slum redevelopment vertical within PMAY-U is particularly significant, as it offers a flexible framework for utilising public–private partnerships (PPP) and land-based financing to improve the economic feasibility of affordable housing projects for urban local bodies. As of September 2025, PMAY-U has sanctioned approximately 122 lakh housing units, with over 113 lakh units under construction and more than 96 lakh units (about 85 per cent) completed and delivered. Central assistance exceeding ₹1,74,923 crore has been allocated, highlighting the programme's scale and fiscal importance.

1.2 The Smart Cities Mission

The introduction of the Smart Cities Mission (SCM) in 2015 represented a significant transformation in India's urban development strategy by combining physical infrastructure development with technology-driven governance and sustainable financing models. The Smart City Mission Guidelines specifically identify affordable housing for the urban poor as a central component of smart city development and encourage cities to integrate housing interventions into their Smart City Plans (SCPs). Consequently, several cities in Karnataka, including Belagavi, Mangaluru, Hubballi– Dharwad, Shivamogga, and Tumakuru, have implemented affordable housing projects through their respective Smart City Special Purpose Vehicles (SPVs). Within this context, the Affordable Housing Project in Tumakuru serves as a notable example of integrated social and spatial

intervention.

The project relocated 87 families from the Mariammanagar slum into newly constructed, fully serviced multi-storey housing units and was completed in 2022 at a total cost of ₹14.07 crore. While the project achieved its social objective of providing secure and dignified housing, its significance extends beyond welfare outcomes. Vertical redevelopment facilitated the release of a substantial portion of centrally located, high-value urban land previously occupied by the slum. This land is designated for monetisation to generate sustainable municipal revenue and partially offset rehabilitation costs. This dual outcome of social upliftment and urban land value capture prompts important questions regarding equity, land-based financing mechanisms, and the long-term sustainability of smart city governance. In this context, the present study evaluates the impact of the Tumakuru affordable housing intervention on smart urbanisation by analysing both household-level social transformation and the strategic implications of land regeneration.

1.3 RESEARCH GAP

Although policy focus and significant public investment in affordable housing under smart city initiatives have persisted, comprehensive empirical assessments of on-the-ground impacts are scarce. Most evaluations of PMAY-U focus on macro-level indicators, such as housing sanctions, fund disbursement, and construction progress, but provide limited analysis of beneficiary-level outcomes, including housing quality, service access, health improvements, and social well-being.

Research on slum rehabilitation housing in metropolitan areas, particularly Mumbai, has revealed mixed outcomes of relocation and underscored the significance of built environment design, social networks, and proximity to livelihoods in determining residential satisfaction. However, empirical studies specifically examining housing interventions for Scheduled Caste (SC) populations are notably limited, even though SC communities represent 16.6 per cent of India's population and continue to face spatial segregation and inadequate access to urban services. The predominance of metropolitan case studies has introduced a geographical bias in literature, leading to insufficient attention to tier-2 cities. The Tumakuru case study addresses both social and spatial gaps by offering micro-level evidence from a medium-sized urban context.

1.4 SIGNIFICANCE OF STUDY

This study holds significance for several reasons. First, it provides primary micro-level evidence on the outcomes of housing transformation among Scheduled Caste migrant beneficiaries, a group often underrepresented in urban housing research. Second, the pre– post comparative design allows for direct attribution of observed improvements in living conditions to the smart city intervention. Third, the development of composite indices for housing quality and social well-being offers replicable methodological tools for evaluating similar projects in other smart cities. Additionally, the findings provide timely policy insights for the recently announced PMAY-U 2.0, which aims to deliver 1 crore additional urban housing units over 5 years,

with an estimated investment of ₹10 lakh crore. By illustrating how affordable housing projects can achieve financial sustainability through land regeneration and monetisation, this study bridges the gap between policy intent and implementation outcomes, thereby informing future urban housing governance strategies.

1.5 OBJECTIVE STATEMENT

Although the Smart Cities Mission prioritises inclusivity, sustainability, and citizen- centric development, the actual impacts of smart affordable housing interventions on beneficiary households, urban morphology, and land-value dynamics are insufficiently documented. There is a critical need to assess whether these projects genuinely promote inclusive and sustainable urban regeneration or are limited to physical improvements within specific redevelopment areas. The Mariammanagar redevelopment in Tumakuru provides an important empirical context to investigate how affordable housing, aligned with smart city principles, influences household well-being, community continuity, land monetisation, and broader urban development trajectories.

1.6 RESEARCH OBJECTIVES

The study is guided by the following specific objectives:

1. **To empirically assess** the impact of affordable housing provision on living conditions, access to basic amenities, and social infrastructure among Scheduled Caste beneficiary households at the Mariammanagar Housing Complex, Tumakuru.

2. **To examine** how post-intervention housing outcomes influence household well-being, social inclusion, and perceptions of dignity using composite index construction and inferential statistical techniques.

3. **To analyse** the contribution of the project to urban regeneration, spatial transformation, and smart urban development in Tumakuru.

2.0 REVIEW OF LITERATURE

Affordable housing is central to current debates on equitable urban development, intersecting with land scarcity, socio-spatial inequality, governance reform, and municipal finance. Scholarly engagement has evolved beyond welfare provisioning to include affordable housing's role in urban regeneration, land-value management, and smart-city transitions. This section critically synthesises key theoretical and empirical contributions relevant to this study, focusing on the evolution of affordable housing concepts, their socio-economic impacts, integration within smart-city frameworks, and the increasing emphasis on land monetisation. The review concludes by identifying gaps addressed by the Tumakuru case.

Conceptual Evolution of Affordable Housing

The conceptualisation of affordable housing has shifted from a narrow welfare-based approach to a multidimensional construct embedded within broader urban economic and governance systems. Dowling et al. (2020) contend that housing affordability is now a structural necessity for sustaining urban productivity, labour mobility, and socio-economic diversity, rather than a residual social-policy concern. This perspective positions affordable housing as integral to urban competitiveness rather than as a compensatory intervention.

Globally, the increasing financialization of housing has reshaped debates on affordability. Li, Aalbers, and Chen (2025), in their analysis of China's affordable rental housing via Real Estate Investment Trusts (REITs), show that state-led financial mechanisms are now used to discipline market capital rather than replace it. These approaches underscore the growing entanglement of affordable housing with investment logics and urban land markets. In India, similar conceptual shifts are observed. Sen (2023) documents the transition from conventional low-cost housing programmes to integrated "smart" and sustainable housing approaches under initiatives such as PMAY and the Smart Cities Mission. These frameworks broaden the definition of affordability to encompass liveability, access to services, environmental performance, and governance quality. Collectively, the literature positions affordable housing as a dynamic policy instrument shaped by economic restructuring, technological change, and evolving urban governance paradigms.

2.1 Implementation Challenges and Structural Constraints

Despite conceptual advances, affordable housing implementation continues to face persistent structural challenges. Aregawi and Genovese (2025) identify land scarcity, speculative pressures, and weak fiscal decentralisation as major barriers in tier-two urban contexts, conditions that closely parallel those in many Indian cities. Lens (2025) further notes that discontinuities in India's supply-side slum redevelopment policies have revealed systemic weaknesses, including rising construction costs, selective targeting, and challenges in maintaining long-term affordability. Regeneration-led housing programmes frequently prioritise physical redevelopment over socio-economic integration. Chin, Rahman, and Othman (2025) demonstrate, through a systematic review, that neglecting livelihoods, social networks, and community stability in housing-led regeneration can perpetuate spatial inequality. These findings highlight the need to evaluate affordable housing not only by unit delivery but also by broader social outcomes and urban restructuring processes.

2.2 Social Outcomes of Housing Transitions

Extensive literature documents the social impacts of transitions from informal to formal housing environments. Banerjee and Duflo (2022) emphasise the dignity-enhancing effects of secure housing, including improvements in social recognition and community

participation among beneficiaries in developing countries. At the neighbourhood level, Venkatesh and Kumar (2021) find that relocation projects with shared spaces and community- oriented design foster greater social cohesion and reduce interpersonal conflict. Housing quality is closely associated with health outcomes.

Krishnan and Patil (2023) report significant reductions in waterborne and respiratory diseases among beneficiaries of slum rehabilitation programs in Maharashtra. Similarly, Reddy et al. (2022) document improvements in child health indicators following transitions from kutcha to pucca housing in Andhra Pradesh. These studies support the argument that housing interventions yield multidimensional benefits beyond shelter provision. Recent scholarship has increasingly adopted rigorous impact-evaluation frameworks. Desai and Thorat (2024) recommend pre–post comparative designs with baseline documentation, while Mehta and Gupta (2023) propose composite housing quality indices that integrate physical, infrastructural, and social dimensions. These methodological advances inform the present study's use of the Housing Quality Index (HQI) and Social Well- being Index (SWI).

2.3 Smart Cities and Affordable Housing

Smart cities constitute a contemporary paradigm in urban development, integrating digital technologies, sustainability objectives, and innovative governance models. Patrocínio, Nunes, and Mateus (2025) propose a human-centric conception of smart cities based on care, proximity, and regenerative design principles that closely align with inclusive, affordable housing strategies. Their work challenges technology-centric narratives by emphasising social equity and community well-being. In the Indian context, Prasad (2024) identifies ongoing tensions between smart-city aspirations and the realities of urban informality, arguing that digital tools should complement, rather than replace, participatory governance mechanisms. Affordable housing in smart cities is, therefore, not only a beneficiary of technological systems such as digital planning, energy-efficient construction, and e-governance, but also a foundational element for legitimising smart urbanism in socially fragmented cities.

2.4 Land Monetisation and Urban Regeneration

Land monetisation has become a key mechanism connecting affordable housing, infrastructure finance, and urban regeneration. Harun and Yigitcanlar (2025) conceptualise urban land as a monetised, data-driven asset within digital economies, transforming how cities mobilise value for redevelopment and social infrastructure. In India, Mittal, Byahut, and Agarwal (2022) recommend ICT-enabled zoning incentives and transit-oriented land-value strategies to channel development gains into affordable housing provision. Institutional mechanisms such as planning gain, value capture, and land readjustment have been shown to support regeneration without imposing excessive fiscal burdens on governments (Thompson & Hepburn, 2022). However, empirical evidence from cities like Addis Ababa indicates that unregulated monetisation can intensify exclusion and affordability constraints (Weldegebriel et al., 2022). These findings highlight the need for governance frameworks that balance value extraction with social equity.

2.5 Smart Affordable Housing as a Regenerative Strategy

Recent scholarship positions affordable housing as a catalyst for urban regeneration when integrated with smart-city systems. Shenvi and Slangen (2018) demonstrate that regulatory tools, including floor-space index

incentives, facilitate redevelopment that generates economic value and delivers inclusive housing outcomes. Arbab (2023) further finds that housing-led regeneration enhances spatial equity and urban imageability while attracting sustainable investment. Chin et al. (2025) synthesize these perspectives and argue that housing-led regeneration is most effective when affordability mechanisms co-evolve with smart infrastructure, digital governance, and land-based financing systems. In this context, affordable housing is positioned not only as a welfare response but also as a strategic intervention capable of reshaping urban socio-spatial structures.

2.6 Existing Study on Mariammanagar Affordable Housing

The National Institute of Urban Affairs (NIUA, 2023) provides an institutional assessment of the Mariammanagar project through its SAAR Compendium of 75 Innovative Projects under the Smart Cities Mission. This compendium features the Mariammanagar initiative as a case study titled *"Slum to Home: Assessment of Housing and Basic Services for the Urban Poor*," documenting project design, implementation processes, and alignment with Sustainable Development Goals. However, the NIUA study offers only descriptive and institutional validation and does not conduct a micro-level empirical assessment of household outcomes or land monetisation impacts. These gaps are addressed in the present study.

2.7 Synthesis and Research Gap

The reviewed literature consistently indicates that affordable housing, when strategically designed, technologically supported, and financially integrated, serves as a powerful instrument for inclusive urban regeneration. However, three critical gaps remain. First, empirical research is disproportionately concentrated on metropolitan regions, with limited attention to medium-sized smart cities that have distinct governance and land-use dynamics. Second, although land monetisation is widely recognised as a financing tool, few studies empirically link specific land-value capture mechanisms to affordable housing outcomes at the project level. Third, micro-scale analyses that capture beneficiary-level social transformation within smart housing projects are scarce. To address these gaps, the present study examines the Mariammanagar Affordable Housing Project in Tumakuru. The research assesses how a smart-city-led housing intervention simultaneously improves living conditions for relocated slum dwellers and operationalises urban regeneration through land-value capture. By integrating household- level outcome analysis with an assessment of land monetisation dynamics, this study contributes to a more nuanced understanding of smart affordable housing in medium-tier Indian cities.

3 Conceptual Framework: Affordable Housing, Smart Urbanisation, And Land Regeneration

The conceptual framework for this study synthesises several theoretical perspectives on housing, human well-being, and urban transformation. Central to this framework is the Capability Approach, as articulated by **Amartya Sen**, which positions adequate housing as a foundational capability that broadens individuals' substantive freedoms to pursue valued ways of living. In this context, housing quality, infrastructure access, and

social amenities are regarded not only as material enhancements but also as instrumental freedoms that support human flourishing, dignity, and social participation.

Within this framework, housing intervention is conceptualised as the primary independent variable influencing a multi-dimensional pathway of outcomes. These outcomes are categorised into three interrelated domains. The first domain concerns **physical infrastructure improvements**, such as housing structure, water supply, sanitation, electricity, and protection from environmental risks. The second domain addresses access to **social infrastructure**, including proximity to community facilities, health services, educational support, and livelihood-related amenities. The third domain pertains to **psychosocial well- being**, encompassing perceptions of dignity, safety, social integration, and neighborhood harmony. These intermediate outcomes collectively influence broader, long-term results, including health status, economic participation, and overall quality of life. The framework acknowledges that the impacts of housing are neither uniform nor automatic. Rather, they are mediated by contextual and moderating factors such as household demographic characteristics, previous housing conditions, duration of residence in informal settlements, and utilisation of complementary public services. This layered approach enables a nuanced assessment of housing outcomes that extends beyond the creation of physical assets.

Additionally, the analytical framework positions **smart urbanisation**, as implemented through the Smart Cities Mission, as an enabling governance context rather than solely a technological intervention. Smart urbanisation is defined to include integrated planning, institutional coordination, and innovative financing mechanisms. Area-Based Development (ABD) zones serve as spatial and administrative platforms for piloting housing-led regeneration in central urban areas. Urban land, especially in centrally located, commercially valuable areas, is a scarce public asset. Mechanisms such as vertical redevelopment, brownfield reuse, and strategic relocation enable cities to unlock latent land value while addressing social housing needs. When land-value gains generated by public intervention are reinvested for public purposes, affordable housing can serve as a catalyst for inclusive urban regeneration rather than as a fiscal burden on smart urbanisation initiatives.

4 RESEARCH METHODOLOGY

4.1 Research Design

A retrospective pre–post research design was employed, utilising primary data collected through structured household surveys. This approach facilitates systematic comparison of housing conditions, infrastructure access, and well-being indicators before and after the affordable housing intervention. Although retrospective designs may introduce recall-related limitations, the recent nature of the transition and the marked contrast between pre-intervention slum conditions and post-intervention formal housing substantially mitigate concerns regarding recall accuracy.

4.2 Study Setting

The research was conducted at the Mariammanagar Affordable Housing Complex in Tumakuru, Karnataka, which was implemented under Tumakuru Smart City Limited. Tumakuru is located approximately 70 kilometres from Bengaluru. Since its designation as a Smart City in 2016, Tumakuru has implemented multiple urban development projects, including transport, water supply, sanitation, and affordable housing initiatives.

The Mariammanagar complex consists of three residential blocks (A, B, and C) with a total of 88 dwelling units. Of these, 87 units have been allotted to beneficiary households, while one unit is reserved for administrative purposes. Block A comprises 24 residential units and community facilities, including an Anganwadi Centre, a Livelihood Centre, and a Community Hall. Blocks B and C each contain 32 residential units, with ground floors designated for vehicle parking.

Each housing unit measures 33.33 square meters and includes a living room, bedroom, kitchen with a granite platform, bathroom with ceramic tile cladding, and a separate Indian- style toilet. Living areas feature vitrified flooring, and common areas feature granite flooring.

4.3 Population and Sample

The study population includes all 87 households residing in the Mariammanagar housing complex. A stratified proportional sampling technique was used to ensure representation from each residential block, proportional to its size. The final sample consists of 24 households: eight from Block A (33.33 per cent of units), eight from Block B (25.00 per cent), and eight from Block C (25.00 per cent), representing 27.58 per cent of the total allotted units. Despite its modest size, the sample provides sufficient statistical power to detect large effect sizes commonly associated with housing interventions and enables detailed, multidimensional data collection at the household level.

4.4 Beneficiary Characteristics

All beneficiary households are members of the Scheduled Caste category within the Hindu religious community. These families are descendants of migrants from the Thiruvannamalai district, Tamil Nadu, who relocated to Tumakuru more than 7 decades ago. This historical context positions the current housing intervention within a broader trajectory of migration, informal settlement, and socio-spatial marginalisation. The housing transition marks the first instance of formal housing access for households that have resided in informal settlements for multiple generations, thereby adding inter-generational significance to the intervention.

4.5 Data Sources and Sampling Design

Primary data were collected through a structured household survey conducted in November 2025 using a pre-designed questionnaire. The instrument captured demographic characteristics, pre-intervention housing

conditions, post-intervention housing features, infrastructure access, utilisation of social facilities, health indicators, economic parameters, and subjective well-being measures. Perception-based items regarding construction quality, adequacy of facilities, safety, and health were measured using Likert scales ranging from 1 (Very Poor) to 5 (Very Good). Surveys were administered through face-to-face interviews with household heads or their representatives, and responses were recorded on standardised survey schedules.

4.6 Variables and Measurement

Both categorical and continuous variables are organised across independent, dependent, and control dimensions. The independent variables representing the housing intervention are housing type (kutcha = 1, semi-pucca = 2, pucca = 3), availability of separate facilities (living room/bedroom, kitchen, toilet: yes = 1, no = 2), flooring type (vitrified = 1, red oxide = 2), source of water supply (inside house = 1, common point = 2), water sufficiency (sufficient = 1, insufficient = 2), and electricity connection (metered = 1, illegal = 2). Dependent variables measure housing and well-being outcomes. These include components of the Housing Quality Index (construction quality, facilities rating, safety perception, flooding concern; each rated on a 1–5 scale), health status change, neighbourhood conflict (pre- and post-intervention), sense of dignity, income change, and women's participation (all measured on 1–5 scales).

Two composite indices were constructed for integrated analysis. The **Housing Quality Index (HQI)** is calculated as the arithmetic mean of the construction quality rating, facilities rating, safety and security rating, and flooding risk rating (reverse-coded). The **Social Well- being Index (SWI)** is computed as the arithmetic mean of the health status rating, the conflict score (transformed to 6 minus the conflict rating), and the dignity rating. Both indices range from 1 to 5, with higher values indicating superior outcomes. Control variables comprise demographic characteristics (gender of household head, family size, age structure), residential block location, and occupational category.

4.7 Analytical Techniques

Data analysis is conducted in multiple stages using appropriate statistical techniques. Descriptive statistics, including frequencies, percentages, means, and standard deviations, characterise the sample and document pre-post-changes. Paired-sample *t*-tests assess the statistical significance of differences between pre-project and post-project conditions for continuously measured variables. Effect sizes are calculated using Cohen's *d* to evaluate the practical significance of observed changes. Threshold values of 0.2, 0.5, and 0.8 are interpreted as small, medium, and large effects, respectively. Correlation analysis examines relationships among housing satisfaction dimensions and well-being indicators.

4.8 Ethical Considerations

The study follows established ethical principles for social science research. Informed consent was obtained from

all participating households prior to data collection. Participation was voluntary, and respondents could decline participation or withdraw at any stage. Data confidentiality was maintained through anonymisation of individual responses, with findings reported only in aggregate form. The research design minimised respondent burden and maximised analytical validity and policy relevance.

5 DATA ANALYSIS AND RESULTS

5.1 Demographic Profile of Sample Households

Table 1 summarises the demographic characteristics of the 24 sampled households. The gender distribution of household heads is evenly split, with 12 male-headed households (50.0 per cent) and 12 female-headed households (50.0 per cent). All sampled households are members of the Hindu religious community (100 per cent) and are classified as Scheduled Caste (100 per cent), aligning with the intended beneficiary profile of the affordable housing intervention.

Table 1: Demographic Characteristics of Sample Households (N = 24)

Characteristic	Frequency	Percentage
Gender of Household Head		
Male	12	50.0%
Female	12	50.0%
Religion		
Hindu	24	100.0%
Caste Category		
Scheduled Caste	24	100.0%
Mean Household Size	4.25	(Range: 2-6)
Mean Male Members	2.08	-
Mean Female Members	2.17	-

Household size ranges from 2 to 6 members, with a mean of 4.25. The average number of male members is 2.08, while the average number of female members is 2.17 per household, indicating a balanced gender composition.

5.2 Pre-Project Housing Conditions

The pre-project housing assessment identified severely inadequate living conditions prior to the Smart City intervention. As indicated in Table 2, 13 households (54.2 per cent) resided in kutcha structures with not plastered mud walls and plastic or tarpaulin roofing, while 11 households (45.8 per cent) occupied semi-pucca structures with brick walls and asbestos sheet roofing. None of the surveyed households lived in pucca housing

during the pre-project period, highlighting the total absence of formal housing among beneficiaries. All households experienced deficits in basic residential facilities. All 24 households (100 per cent) lacked separate living and bedroom spaces, kitchen facilities, and individual toilets. Of those without private toilets, 17 households (70.8 per cent) relied on paid public toilets, while 7 households (29.2 per cent) used community toilets, resulting in financial and logistical challenges. Notably, none of the households reported open defecation.

Table 2: Pre-Project Housing Conditions (N = 24)

Variable	Frequency	Percentage
Housing Structure Type		
Kutcha (Mud walls, plastic/tarpaulin roof)	13	54.2%
Semi-Pucca (Brick walls, asbestos roof)	11	45.8%
Pucca	0	0.0%
Separate Living/Bedroom Space		
Yes	0	0.0%
No	24	100.0%
Separate Kitchen Facility		
Yes	0	0.0%
No	24	100.0%
Individual Toilet Facility		
Yes	0	0.0%
No	24	100.0%

All households relied exclusively on a single public tap for water supply. While all households reported regular electricity connections, field observations revealed variability in service quality, which is typical in informal settlements. Households frequently use adjacent drainage areas for washing utensils, bathing, and other domestic activities, creating unhygienic conditions and significant public health risks. These baseline conditions underscore the extent of deprivation prior to the housing intervention.

5.3 Post-Project Housing Transformation

The post-project assessment indicates comprehensive improvements in all housing and infrastructure dimensions. As shown in Table 3, all 24 households (100 per cent) now reside in pucca housing units, marking a complete transition from kutcha and semi-pucca structures.

Table 3: Post-Project Housing Conditions (N = 24)

Variable	Frequency	Percentage
Housing Structure Type		
Pucca	24	100.0%
Separate Living/Bedroom Space		
Yes	24	100.0%
Separate Kitchen with Granite Platform		
Yes	24	100.0%
Individual Toilet (Indian style, tiled)		
Yes	24	100.0%
Vitrified Tile Flooring		
Yes	24	100.0%
Water Supply Inside House		
Yes	24	100.0%
Daily Water Supply		
Yes	24	100.0%
Water Sufficiency		
Sufficient	24	100.0%
Water Source: Borewell with OH Tank		
Yes	24	100.0%
Individual Electricity Meter		
Yes	24	100.0%
Daily Waste Collection		
Yes	24	100.0%

All households now have access to separate living and bedroom spaces, kitchens with granite platforms, and individual Indian-style toilets with tiled cladding. Vitrified tile flooring has been installed in all units, enhancing hygiene and durability. Water supply infrastructure has been significantly upgraded, with daily piped water provided inside each dwelling from borewells connected to overhead tanks. All households report sufficient water availability. Formalisation of service formalisation is demonstrated by the installation of individual electricity meters for all units. Additionally, daily solid waste collection services are provided uniformly across the housing complex, addressing environmental hygiene issues. Collectively, these enhancements constitute a complete transformation in housing adequacy and service delivery.

5.4 Pre-Post Comparative Analysis

Table 4 provides a systematic comparison of key housing parameters before and after the intervention

Table 4: Comparative Analysis of Housing Parameters (N = 24)

Parameter	Pre-Project	Post-Project
Pucca Housing	0 (0.0%)	24 (100.0%)
Separate Living/Bedroom	0 (0.0%)	24 (100.0%)
Separate Kitchen	0 (0.0%)	24 (100.0%)
Individual Toilet	0 (0.0%)	24 (100.0%)
Indoor Water Supply	0 (0.0%)	24 (100.0%)
Daily Water Availability	Variable	24 (100.0%)
Individual Electric Meter	0 (0.0%)	24 (100.0%)
Floor Area (sq. ft.)	Undefined/Variable	358.5

Table 4 provides a systematic comparison of key housing parameters before and after the intervention. The findings indicate a complete transition from zero access to universal access (100 per cent) across all core housing and service indicators, such as pucca housing, separate living space, kitchen facilities, individual toilets, indoor water supply, and individual electricity meters. This transition constitutes the maximum possible improvement in housing adequacy, signifying a fundamental enhancement in both housing quality and residential security. The results demonstrate a substantial increase in the Housing Quality Index, corresponding to the shift from severe deprivation to fully serviced formal housing.

5.5 Beneficiary Satisfaction Assessment

Table 5 presents beneficiary satisfaction ratings across five dimensions. Mean scores exceed 4.0 for all dimensions except flooding concerns, reflecting high levels of satisfaction. Facilities provided received the highest mean rating (M = 4.58, SD = 0.65), followed by construction quality (M = 4.42, SD = 0.65) and safety and security (M = 4.33, SD = 0.76). Improvement in health status was also rated positively (M = 4.21, SD = 0.72).

Table 5: Beneficiary Satisfaction Ratings (N = 24)

Dimension	Mean	SD	Interpretation
Construction Quality	4.42	0.65	Good to Very Good
Facilities Provided	4.58	0.65	Good to Very Good
Safety and Security	4.33	0.76	Good to Very Good
Health Position	4.21	0.72	Good
Flooding Concerns	3.62	0.58	Neutral to Good

Flooding concerns received a comparatively lower mean rating (M = 3.62, SD = 0.58), indicating the need for additional attention to drainage and site-level infrastructure. The low standard deviations across all dimensions suggest consistency in beneficiary perceptions.

5.6 Social Well-Being Indicators

Table 6 presents pre- and post-intervention comparisons of social well-being indicators.

Table 6: Social Well-Being Indicators Analysis (N = 24)

Indicator	Pre-Project	Post-Project	t-value	p-value	Cohen's d
Conflict with Neighbours	M=4.29, SD=0.62	M=1.62, SD=0.82	11.98	<0.001	3.65
Sense of Dignity	M=1.67, SD=0.64	M=4.08, SD=0.50	-13.45	<0.001	4.21
Note: Scale: 1 = Very Low to 5 = Very High. For conflict, lower scores indicate improvement. For dignity, higher scores indicate improvement					

The results demonstrate statistically significant improvements of exceptional magnitude. Conflict with neighbours declined markedly from a pre-project mean of 4.29 (SD = 0.62) to a post-project mean of 1.62 (SD = 0.82). The paired-sample *t*-test yielded a value of 11.98 ($p < 0.001$), with a Cohen's *d* of 3.65, indicating an exceptionally large effect size. Similarly, sense of dignity increased substantially from a pre-project mean of 1.67 (SD = 0.64) to a post-project mean of 4.08 (SD = 0.50). The corresponding *t*-value of −13.45 ($p < 0.001$) and Cohen's *d* of 4.21 confirm an exceptionally strong intervention effect. These findings indicate that the housing intervention resulted in substantial improvements in social relations, self-perception, and neighborhood harmony

5.7 Health and Income Indicators

Health status assessment shows that 16 households (66.7 per cent) reported no illness among family members during the three months preceding the survey, while 8 households (33.3 per cent) reported some illness. These outcomes should be considered in the context of improved sanitation, housing quality, and access to periodic health camps conducted at the community hall. Changes in income following relocation display a mixed pattern. While 11 households (45.8 per cent) reported improved income and 2 households (8.3 per cent) reported significant improvement, 7 households (29.2 per cent) reported somewhat decreased income and 1 household (4.2 per cent) reported decreased income. The mean income change score of 3.25 suggests modest overall improvement and underscores the need for complementary livelihood interventions to address adjustment-related income disruptions.

5.8 Social Infrastructure Utilisation

The housing complex contains several community facilities intended to enhance resident welfare. The Anganwadi Centre in Block A serves 25 enrolled children and provides early childhood education and nutrition services. Among households with school-age children, improvements in study conditions were widely reported. The Community Hall is actively used for social functions and hosts monthly health camps conducted by the Public Health Centre. In contrast, the Livelihood Centre remains underutilised. Although Hasirudala NGO conducts awareness programmes, structured skill development or income-generation programmes, particularly those targeting women and youth, are absent. This represents a missed opportunity to reinforce economic outcomes alongside housing improvements.

6 AFFORDABLE HOUSING AS A TOOL FOR LAND REGENERATION

6.1 Productive Reuse of Municipal Land

The project exemplifies effective brownfield redevelopment by transforming a non- performing municipal asset into a fully operational residential complex. This outcome underscores the capacity of affordable housing initiatives to activate idle urban land and address social housing requirements

6.2 Recovery of High-Value Central Urban Land

This project demonstrates the productive reuse of underutilised municipal and government land through brownfield redevelopment. A housing complex was constructed on an adjacent municipal land parcel of 2,883 sq. m in Survey No. 120, which previously contained a dilapidated structure and informal settlements. After clearance and redevelopment, 87 families were relocated to the new residential complex. This intervention has enabled the potential recovery of 3,136 sq. m of centrally located urban land formerly occupied by the original slum, and its future use is subject to administrative and planning procedures. Additionally, a nearby government-owned parcel of approximately 8,903 sq. m, previously allotted to a state-owned Development Corporation for the construction of Ambedkar Bhavan but left vacant due to presence of nearby slum as informal occupation , remains available for future development. Collectively, these outcomes underscore the role of affordable housing initiatives in activating underutilised urban land for Land Monetisation needs

6.3 Financial Sustainability and Governance Considerations

The project cost of ₹14.07 crore may be offset through partial monetisation of the proposed reclaimed land parcel of 3,136 sq. m. Using conservative estimates of ₹25,000 per sq. m, the reclaimed land constitutes a significant fiscal resource. However, to ensure that public interest objectives are upheld, it is essential to establish governance mechanisms that ensure land monetisation becomes a reality and proceeds are reinvested in social infrastructure, affordable housing, and inclusive urban development.

7 DISCUSSION OF FINDINGS

The findings present strong evidence of the transformative impact of affordable housing delivered through the Smart Cities Mission framework. The universal shift from informal kutcha and semi-pucca housing to pucca housing signifies a substantial improvement in housing security, aligning with the national objectives of PMAY and Smart City guidelines. The comprehensive provision of basic facilities, transitioning from no access to universal access, represents the greatest attainable improvement in housing adequacy. Social outcomes are especially notable, with substantial effect sizes observed for reductions in neighbourhood conflict and improvements in dignity, highlighting the psychosocial benefits of formal housing. High satisfaction levels across most dimensions indicate strong beneficiary acceptance. However, the relatively low flooding score suggests a need for enhanced drainage management. The mixed income outcomes emphasise the importance of integrating livelihood support with housing provision, particularly through more effective use of the Livelihood Centre. The project further demonstrates that affordable housing can function as an effective instrument for land regeneration. Unlocking high-value central land and converting underutilised municipal assets into productive use aligns social inclusion with fiscal sustainability, thereby reinforcing the strategic role of housing in smart urbanisation.

8 POLICY IMPLICATIONS

The findings yield several significant policy implications for the design and implementation of affordable housing interventions under the Smart Cities Mission and the forthcoming PMAY–Urban 2.0 framework. The comprehensive improvement in housing facilities observed in the Mariammanagar project demonstrates the effectiveness of integrated housing packages that address multiple dimensions of infrastructure provision. Policy frameworks should require minimum, non-negotiable facility standards, such as separate living and kitchen spaces, individual toilets, formal electricity connections, and a reliable daily water supply, to ensure substantive improvements in housing adequacy rather than incremental upgrades. The integration of social infrastructure, including Anganwadi centres, community halls, and health service delivery points, demonstrates the potential for housing projects to serve as platforms for comprehensive urban poverty alleviation. The availability of monthly health camps and early childhood services suggests that affordable housing can deliver welfare outcomes beyond shelter. However, the underutilisation of the Livelihood Centre highlights the necessity for active programming, institutional partnerships, and outcome- focused service delivery rather than simply providing physical facilities.

The substantial improvements observed in social well-being indicators, particularly reductions in neighbourhood conflict and enhancements in dignity, indicate that housing interventions can generate significant psychosocial benefits. Consequently, impact assessment frameworks for PMAY–Urban 2.0 should incorporate social and well-being indicators alongside conventional physical infrastructure metrics to capture the full range of programme outcomes. The mixed income trajectories among beneficiary households suggest

that housing provision alone does not guarantee livelihood improvement and may, in some instances, temporarily disrupt existing economic arrangements. This finding underscores the importance of integrating livelihood support measures, vocational training, and income- generation facilitation within housing programmes, particularly for women and youth, to ensure sustainable welfare gains. The emphasis on Scheduled Caste households with multi-generational residence in informal settlements demonstrates the potential of affordable housing programmes to address entrenched social disadvantages and promote social inclusion. Targeted interventions for historically marginalised communities should remain central to PMAY–Urban 2.0, supported by systematic documentation of social identity dimensions in beneficiary selection and impact evaluation. This project demonstrates that **slum relocation projects, when designed with vertical redevelopment and strategic land management, can facilitate urban land regeneration**. The recovery and monetisation of centrally located land can improve the financial viability of affordable housing initiatives, transforming them from fiscally burdensome programmes into remunerative and self-sustaining urban interventions when governed by appropriate public- interest safeguards.

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