Journal of Civil Engineering and Architecture 20 (2026) 271-280
doi: 10.17265/1934-7359/2026.07.002

Research on Sustainable, Affordable Housing Models for Migrants Using Prefabricated Construction Technology in Ho Chi Minh City

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Abstract: Rapid urbanization and the continuous growth of migrant populations in Ho Chi Minh City have created significant pressure on the urban housing system, particularly in the affordable housing sector. However, the development of low-cost housing for migrants still faces many challenges related to construction costs, land availability, construction duration, and environmental sustainability. This study focuses on exploring sustainable, affordable housing models for migrants through the application of prefabricated construction technology in Ho Chi Minh City. The research employs methods of literature review, comparative analysis, and evaluation of domestic and international prefabricated housing practices to identify the advantages and feasibility of this construction approach. The findings indicate that prefabricated construction technology offers numerous benefits, including reduced construction time, lower labor costs, improved quality control, minimized material waste, and enhanced environmental performance. Based on these advantages, the paper proposes a sustainable multi-storey affordable housing model suitable for the socio-economic and urban conditions of Ho Chi Minh City, emphasizing flexibility, adaptability, cost efficiency, and improved living quality for low-income migrants. The study concludes that prefabricated construction technology can become an effective solution for promoting sustainable, affordable housing development while contributing to the industrialization and modernization of Vietnam's construction sector.

Key words: Affordable housing, migrants, prefabricated construction, precast technology, Ho Chi Minh City.

1. Introduction

HCMC (Ho Chi Minh City) is a major economic and urban hub in Vietnam, attracting a large influx of migrant workers driven by industrialization and the growth of the service sector. This rapid mechanical population growth has placed significant pressure on infrastructure systems, particularly regarding housing demand. Currently, the majority of low- and middle-income migrants reside in privately owned rental units characterized by cramped spaces and poor quality, with living conditions that fall short of standards for safety, amenities, and environmental sustainability (Fig. 1). Although the city has implemented various social housing and worker housing programs, the supply still fails to meet actual demand due to constraints regarding land availability, investment capital, construction costs, and project timelines.

Against this backdrop, modular construction technology is viewed as a promising solution for enhancing the efficiency of affordable housing development. Manufacturing components in factories and assembling them on-site helps shorten construction times, improve build quality, lower labor costs, minimize waste, and reduce environmental impact. Many countries—such as Japan, Singapore, China, and Sweden—have successfully employed this technology in the development of social and affordable housing. However, in Vietnam and HCMC, the application of modular construction

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Fig. 1 Worker housing on Tran Xuan Soan Street affected by high tides in Ho Chi Minh City.
Source: Authors, 2024.

technology for housing targeted at migrants remains limited, and there is a lack of research evaluating its suitability under actual conditions.

Given this context, the study aims to achieve two primary objectives: (1) to evaluate the applicability of modular construction technology for developing affordable housing for migrants in HCMC by analyzing its advantages, limitations, and feasibility; and (2) to propose a sustainable, affordable housing model utilizing modular technology that meets the housing needs of migrants while aligning with the city's goals for sustainable urban development and the industrialization of the construction sector.

2. Literature Review

2.1 Affordable Housing and Sustainable Housing

Amid rapid urbanization, the concept of affordable housing is garnering increasing attention across the globe. According to UN-Habitat [1], affordable housing refers to housing that is priced within the means of low- and middle-income groups while ensuring access to infrastructure and basic services.

Sustainable housing aims to strike a balance among economic efficiency, social equity, and environmental protection [2]. For low-income migrants, integrating these criteria is crucial for improving quality of life and maintaining affordability, making it a priority focus for many nations.

2.2 Migrants and Housing Demand in Developing Urban Areas

Urbanization and industrialization have driven a surge in rural-to-urban migration, particularly in developing nations. While migrants contribute significantly to the economy, they often face barriers to accessing housing due to low incomes and limited legal status, forcing them to reside primarily in low-quality rental units or substandard neighborhoods. In Vietnam—especially in HCMC and neighboring industrial provinces—a persistent shortage of housing for workers and migrants remains a critical issue, necessitating affordable housing solutions that meet actual needs [3, 4].

2.3 Prefabricated Construction Technology in Housing Development

Prefabricated construction technology is considered an effective solution for enhancing productivity and reducing construction costs by manufacturing components in factories and assembling them on-site. Precast concrete structural systems facilitate standardization and quality control while reducing labor costs, making them well-suited for large-scale housing projects [5, 6]. Meanwhile, modular housing offers advantages such as design flexibility, scalability, shorter construction times, and reduced carbon emissions [7]. These characteristics demonstrate the significant potential of prefabricated technology for developing affordable and sustainable housing in growing urban areas.

2.4 The Experience in the Development of Modular Housing

Many countries have successfully utilized modular construction technology to develop social and affordable housing. Singapore is a pioneer in applying industrialized construction technology to social housing; through the HDB (Housing & Development Board) program, over 80% of Singapore's population currently resides in housing built using advanced prefabrication technologies. The Singaporean government has adopted the PPVC

(Prefabricated Prefinished Volumetric Construction) system, which significantly reduces construction time and enhances build quality [8].

China has vigorously implemented a program for the development of prefabricated housing since 2015, aiming to reduce emissions and enhance resource efficiency. According to the Ministry of Housing and Urban-Rural Development of China [9], the proportion of prefabricated buildings in major cities has risen rapidly, particularly within the sectors of social housing and accommodation for migrant workers [10].

Meanwhile, Japan is recognized as a global leader in the prefabricated housing industry, home to prominent companies such as Sekisui House, Daiwa House, and Misawa Homes. Prefabricated housing in Japan is highly regarded for its quality, earthquake resistance, and structural longevity. Integrated factory-based manufacturing technologies help reduce operational costs and ensure high technical precision [11].

The experience demonstrates that modular construction technology is not merely a technical solution but also a crucial tool for addressing the challenge of affordable housing amidst rapid urbanization (Fig. 2).

2.5 Research Gap

Previous studies have primarily focused on three distinct areas: (i) affordable and social housing; (ii) the housing needs of migrants; and (iii) prefabricated construction technology and construction industrialization [12]. However, research integrating all three of these elements remains relatively limited, particularly within

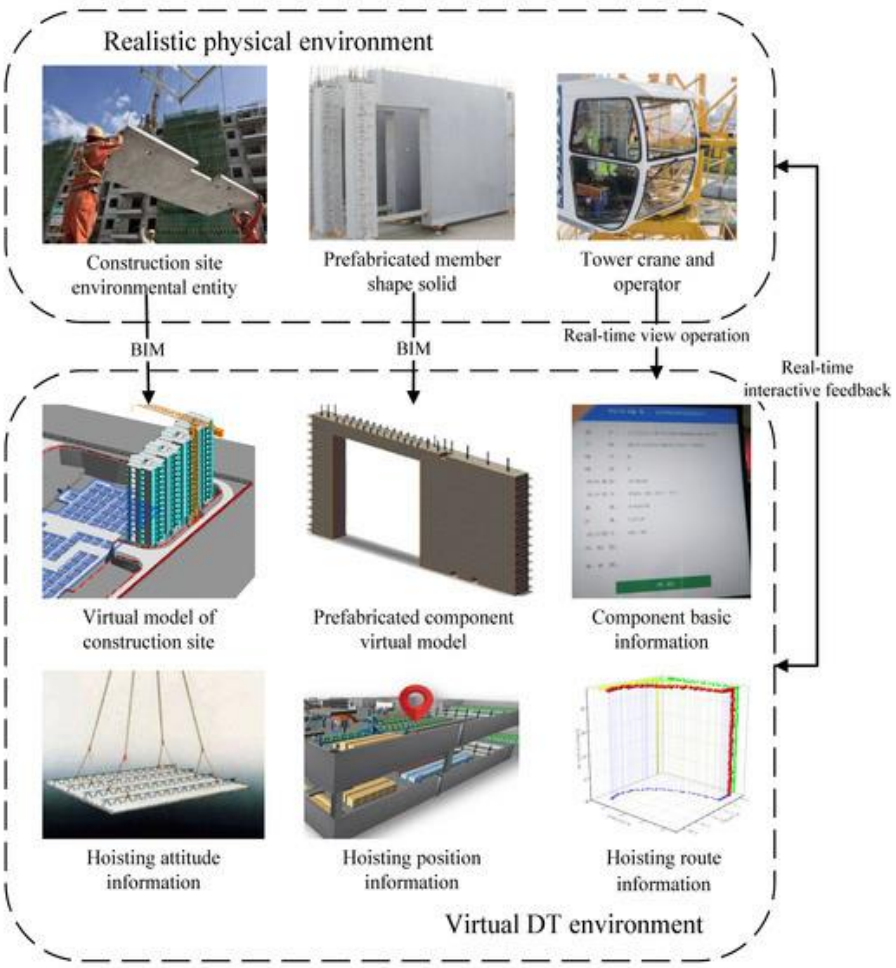

Fig. 2 Framework of hoisting control method based on DTm.
Source: Zhao, Y., Cao, C., and Liu, Z. 2022 [13].

the context of developing urban areas. In Vietnam, research on affordable housing has largely centered on social housing development policies, housing affordability, or residential planning solutions. Meanwhile, studies on prefabricated construction technology have mostly approached the subject from the perspectives of construction techniques, materials, and project management. There is a lack of research evaluating the applicability of prefabricated technology as a comprehensive solution for developing affordable housing specifically for migrants in HCMC [14]. Therefore, this study aims to address this gap by analyzing the potential of prefabricated construction technology for sustainable, affordable housing development and proposing a housing model suited to the socio-economic conditions and urban development trajectory of HCMC.

3. Method and Materials

The study employs an interdisciplinary approach—integrating architecture, urban planning, housing management, and construction technology—to evaluate the applicability of modular construction technology in developing sustainable, affordable housing for migrants in HCMC. The research methodology comprises three main components: data collection, data analysis, and the development of a model evaluation framework.

3.1 Data Collection Method

Data were gathered through a SLR (systematic literature review), utilizing reports from international organizations, regulatory bodies, and academic studies concerning affordable housing, sustainable housing, migrants, and modular construction technology. Additionally, statistics regarding population, migrant labor, income, and housing demand in HCMC were compiled from official sources. The study also analyzes exemplary models from Singapore, China, Japan, and Sweden to derive insights applicable to the local context.

3.2 Analytical Method

The study employs a comparative analysis to contrast traditional construction methods with modular assembly approaches based on criteria such as cost, construction duration, quality, material efficiency, environmental impact, and flexibility. A SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) is used to evaluate the strengths, weaknesses, opportunities, and challenges associated with implementing these models in HCMC (Table 1). In addition, the MCA (multi-criteria assessment) method simultaneously considers economic, social, and environmental factors, including affordability, the quality of living spaces, access to infrastructure, energy efficiency, and emission reduction. The results of this assessment serve as the basis for developing the housing model proposed in the next section of the study (Table 2).

3.3 Proposed Housing Model Evaluation Framework

Based on the analysis results, an evaluation framework comprising five criteria was developed: affordability, flexibility, land-use efficiency, environmental sustainability, and scalability (Fig. 3). This framework serves as the foundation for evaluating existing models and proposing a sustainable, affordable housing model suited to HCMC's development context.

Table 1 Assessment of the feasibility of implementing affordable housing models using modular construction technology in HCMC.

Strengths Evaluate advantages regarding technology, construction time, quality, and economic efficiency.	Weaknesses Identify limitations concerning initial investment capital, technology, and human resources.
↓	↓
Opportunities Assess market demand, housing development policies, and trends toward the industrialization of construction.	Threats Consider risks related to legal matters, investment costs, and market acceptance.

Source: Authors, 2026.

Table 2 Three groups of evaluation criteria for selecting a suitable model.

Economic criteria group	Social criteria group	Environmental criteria group
• Construction costs; • Operating costs; • Affordability for migrants.	• Quality of living space; • Living amenities; • Adaptability to diverse resident groups; • Accessibility to social infrastructure.	• Energy efficiency; • Emissions reduction potential; • Resource use efficiency; • Recyclability of construction materials.

Source: Authors, 2026.

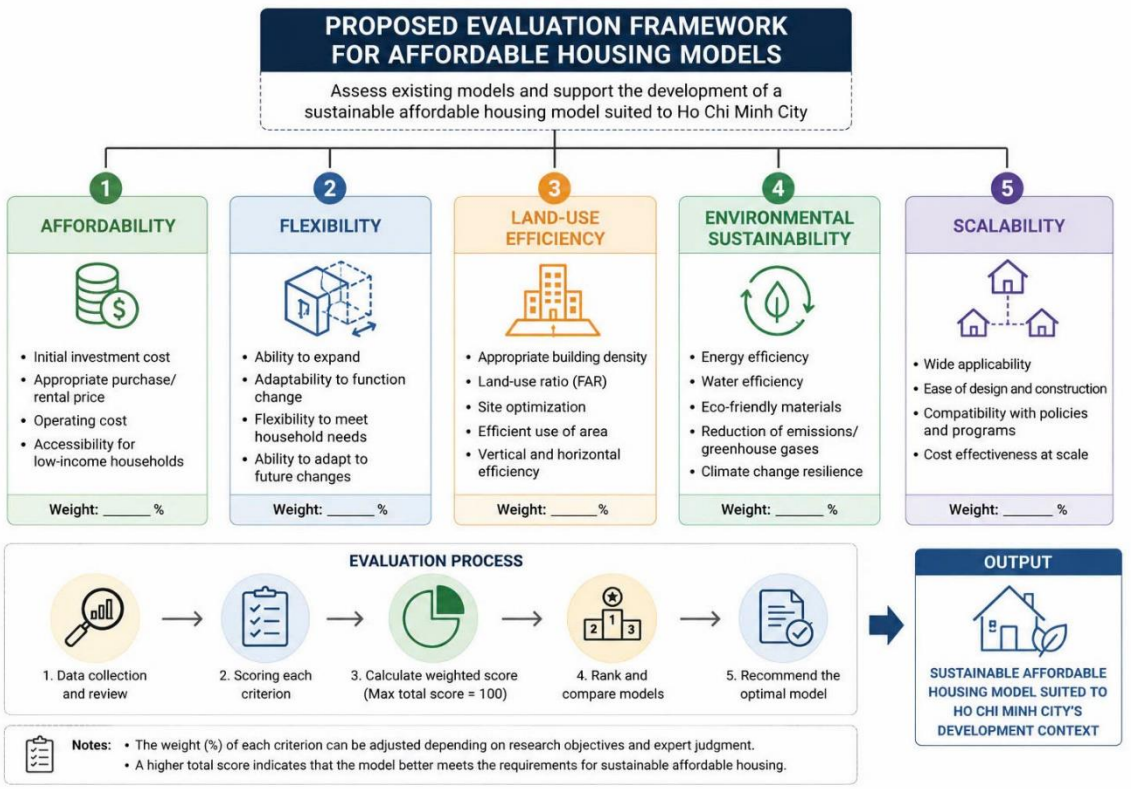

Fig. 3 Proposed framework for evaluating affordable housing models.

Source: Authors, 2026.

4. Housing Demands of Migrants Based on Survey Results

4.1 Forecast of Housing Demand among Migrants in HCMC

Population and migrant projections for HCMC: the city's population is projected to reach approximately 12-14 million by 2030. Migrants are expected to account for 30-40% of this total (equivalent to 3.5-5 million people), placing significant pressure on infrastructure and creating a substantial need for affordable housing [3, 4].

Forecast of affordable housing demand in HCMC: Research estimates that the city will require approximately 700,000-1,200,000 affordable housing units by 2030. Low-cost rental housing accounts for the largest share (40-50%), followed by social housing (30-40%) and low-priced commercial housing (10-20%). Demand is concentrated mainly in suburban districts such as Binh Chanh, Hoc Mon, Nha Be, and Cu Chi, while also extending to neighboring urban areas in Binh Duong and Dong Nai Provinces, reflecting a trend of multi-polar urban development [14].

4.2 Assessment of the Potential Application of Prefabricated Construction Technology

Research findings indicate that prefabricated construction technology offers significant advantages

for affordable housing development. Economically, off-site component manufacturing minimizes material waste, reduces construction time by 30-50%, lowers management costs, and facilitates mass production. Technically, the technology enhances quality, durability, and project control while allowing for flexible spatial adjustments or expansions through modular design. Environmentally, the prefabricated method helps reduce construction waste and carbon emissions, conserves resources, and mitigates on-site pollution. However, implementation in Vietnam faces challenges such as high initial investment costs, a lack of standardized technical specifications, limited human resources, and varying levels of market acceptance for new technologies. Nevertheless, a SWOT analysis suggests that prefabricated construction technology holds great potential for large-scale affordable housing development in HCMC, particularly in suburban areas and emerging industrial development hubs [12].

4.3 Conditions for Implementation in HCMC

HCMC possesses several favorable conditions for implementing an affordable housing model utilizing modular construction technology. These include a strategic focus on developing suburban housing areas, preferential land and credit policies for social housing, and a well-developed supply chain for construction materials and precast concrete components in the Southeast region. Furthermore, the policy of industrializing the construction sector and adopting advanced technologies creates a solid foundation for scaling up this model (Fig. 4). Under Vietnam's construction sector development

Fig. 4 Conditions applicable in HCMC.
Source: Authors, 2026.

strategy through 2030, modular construction technology is being prioritized for development and recognized as a key solution for boosting labor productivity, reducing emissions, and modernizing the industry. A synthesis of the analysis indicates that combining the rising demand for housing with the advantages of modular construction technology can lead to the creation of a sustainable, affordable housing model that meets requirements regarding affordability, construction quality, and long-term urban development in HCMC.

5. Proposal for a Sustainable, Affordable Housing Model Using Prefabricated Construction Technology

Based on an analysis of housing needs among migrants in HCMC, the study finds that the current supply of affordable housing is inadequate in terms of both quantity and quality, while traditional construction methods fail to meet requirements regarding cost, construction time, land-use efficiency, and sustainable development. The study proposes a sustainable, affordable housing model for low- and middle-income migrant workers. This model prioritizes affordability, efficient land use, operational flexibility, energy efficiency, and scalability within the context of HCMC's urbanization [16, 17].

5.1 Proposed Principles

Based on an analysis of housing needs among migrants, and evaluations of modular construction technology, the proposed model is built upon the following five fundamental principles: (1) ensuring affordability by reducing construction costs through design standardization, mass production of components, and shortened construction times; (2) utilizing land efficiently by developing multi-story buildings with appropriate density to optimize urban space; (3) enhancing flexibility and adaptability to meet the needs of diverse resident groups, ranging from single individuals to small families; (4) ensuring environmental sustainability through energy efficiency, the utilization of natural ventilation and lighting, and the use of eco-friendly materials; and (5) the model must be scalable, facilitated by standardized structural systems and construction processes.

5.2 Model Structure and Structural Solution

The study proposes a mid-rise apartment model ranging from 4 to 8 stories, suitable for the development conditions and investment capacity of HCMC. The ground floor accommodates public functions such as parking areas, lobbies, community spaces, services, and technical infrastructure. Residential floors are organized around a central corridor with two vertical circulation cores, featuring approximately 20-30 apartments per floor to optimize usable area and meet safety requirements (Fig. 5).

The building utilizes a precast reinforced concrete system; major components—such as columns, beams, floor slabs, walls, and staircases—are factory-manufactured and assembled on-site. This is combined with cast-in-place concrete for the foundation and specific elements requiring high structural connectivity (Fig. 6).

5.3 Apartment Spatial Organization

The proposed model features two primary apartment types: a studio unit of approximately 28 m² for singles or small households, and a one-bedroom unit of approximately 42 m² for young families. The apartments utilize a modular design principle where bathrooms and loggias are fixed around the technical core, while the remaining spaces allow for flexible layout arrangements based on usage needs. By employing prefabricated structural systems and standardized modular design, the apartments can adapt their function to changing needs or be combined to expand living space as household size grows [18]. This solution supports personalization and enhances long-term adaptability, while simultaneously reducing initial investment costs and improving housing accessibility for low-income earners.

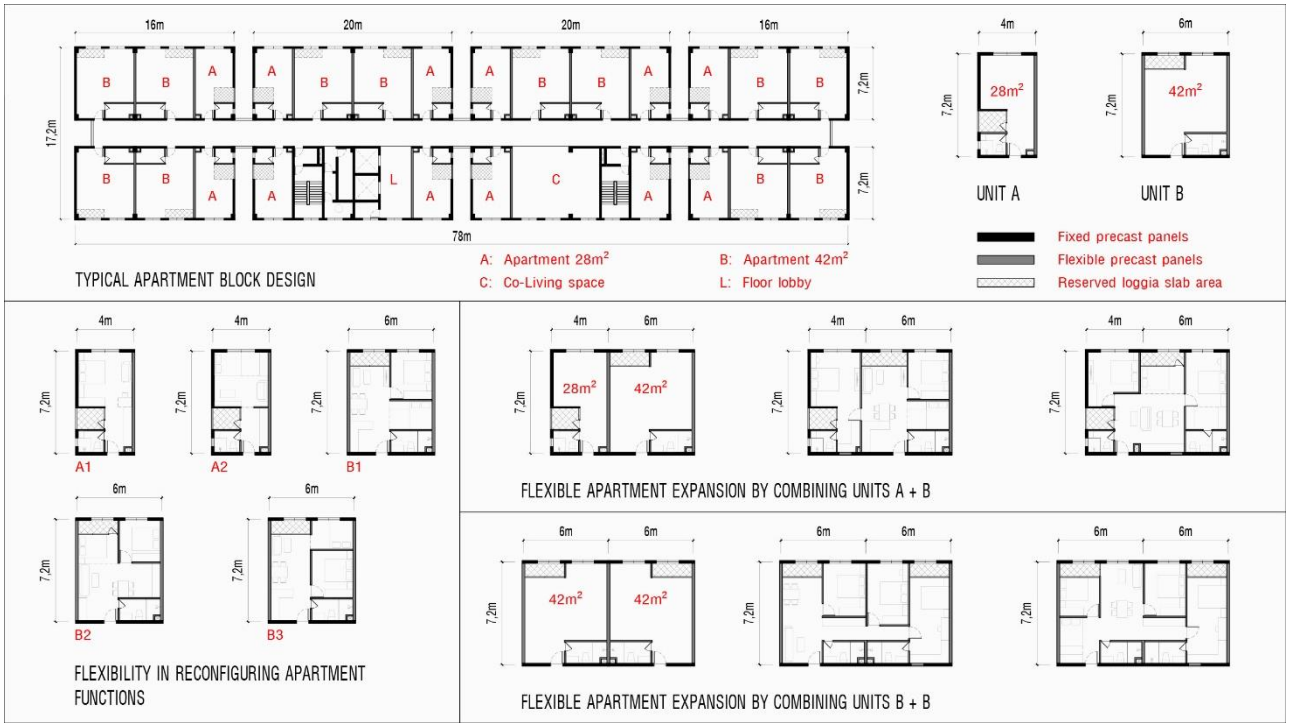

Fig. 5 Proposed apartment layout and modular configurations.
Source: Authors, 2026.

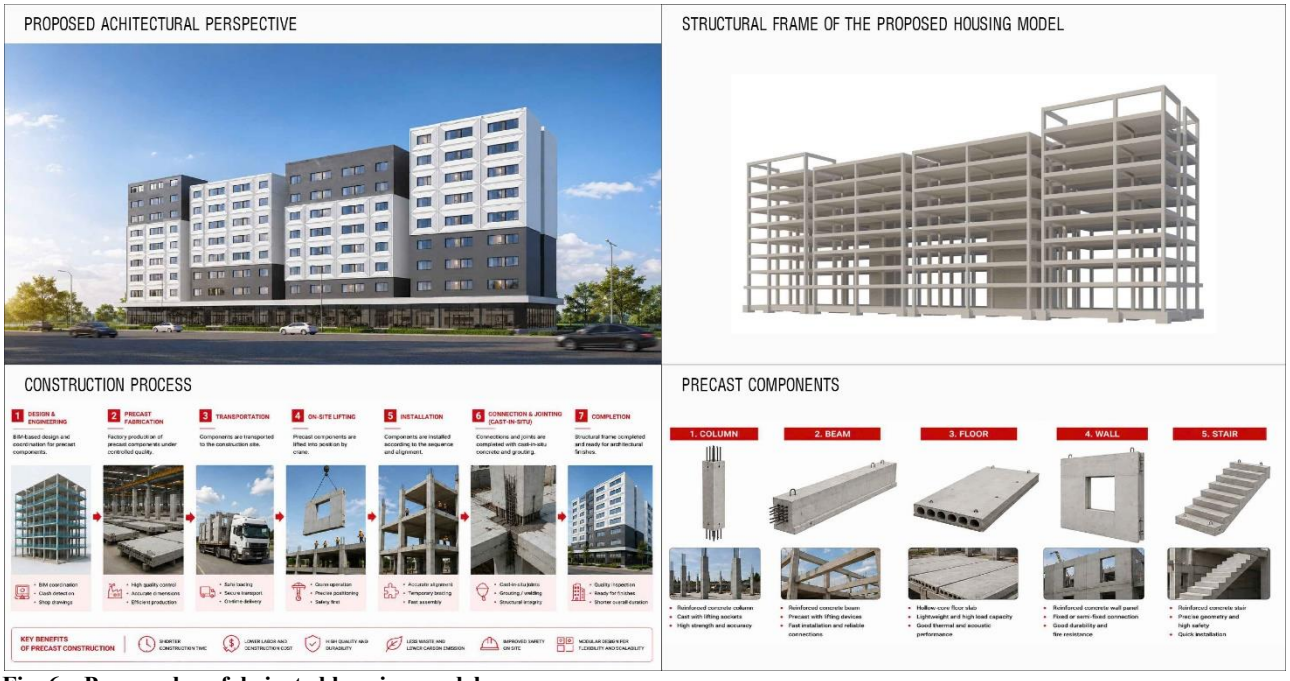

Fig. 6 Proposed prefabricated housing model.
Source: Authors, 2026.

5.4 Architectural and Technical Solutions

The building utilizes natural ventilation and daylighting through open corridors, atriums, and door systems, thereby reducing the need for air conditioning and artificial lighting. The use of prefabricated concrete structures helps conserve materials, minimize construction waste, lower carbon emissions, and

enhance the quality of the structure. Furthermore, the model can incorporate green technical solutions—such as rainwater harvesting and reuse, solar power systems for common areas, and expanded green spaces and community areas—to improve the microclimate, reduce operating costs, and enhance the quality of the living environment.

6. Conclusions

The study affirms that developing sustainable, affordable housing for migrants is an urgent necessity as HCMC grapples with rapid urbanization, mechanical population growth, and the need to ensure social welfare. By synthesizing theoretical frameworks and international experiences, the study demonstrates that prefabricated construction technologies—particularly precast concrete systems and modular housing—hold significant potential for affordable housing development. These methods offer advantages such as shorter construction times, reduced costs, improved build quality, minimized construction waste, and the capacity for mass production.

Based on this foundation, the study proposes a sustainable affordable housing model utilizing prefabricated construction technology in the form of mid-rise apartment buildings (4-8 stories). The model employs prefabricated concrete structures combined with flexible, energy-efficient, and eco-friendly modular designs. Apartment units range from 25 m² to 45 m², catering to the diverse needs of migrants and incorporate community spaces alongside modern management solutions to enhance the quality of life. Evaluation results indicate that the model effectively meets criteria regarding affordability, flexibility, land-use efficiency, environmental sustainability, and scalability. The study provides a scientific basis for integrating affordable housing development with prefabricated construction technology within the Vietnamese context, offering valuable insights for policymakers and investors regarding policy planning and project implementation.

Acknowledgments

Part of the research for this paper was conducted by Ngo Le Minh and colleagues, with funding support from the Ho Chi Minh City Department of Science and Technology in the period 2024-2026. The authors would like to express sincere gratitude to the Ho Chi Minh City Department of Science and Technology, Ton Duc Thang University, and colleagues who participated in the research.

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