Tackling Hong Kong's Housing Shortage with BIM and Modular Construction Technology

CSCI 3250: Computers and Society — Case Study

Social Issue Analysis and Technology Proposal

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Abstract

Hong Kong's housing crisis is among the most acute in the world. As at end-March 2025, there were about 116,400 general applications on the public rental housing waiting list, with both the composite waiting time and average waiting time for general applicants standing at about 5.3 years, well above the government's own target of three years [1]. Private residential prices remain the highest in the world, with Hong Kong topping global rankings despite a prolonged market correction [2]. This report identifies the structural undersupply of public housing as a critical social problem with wide-ranging consequences for quality of life, social mobility, and public health. It proposes the adoption of Building Information Modelling (BIM) integrated with Modular Integrated Construction (MiC) as a technology-driven approach to accelerating public housing delivery, and evaluates this proposal against Hong Kong's regulatory, geographic, and social context.

Contents

1 Problem Identification

1.1 The Depth of Hong Kong's Housing Crisis

Hong Kong's housing problem is not a recent development, but its severity has intensified over the past two decades. The city has one of the highest population densities in the world, yet usable land for residential development remains severely constrained. About 40% of Hong Kong's land area is designated as Country Parks and Special Areas under the Country Parks Ordinance, and the existing protected and preserved areas cover about 540 km^2; many areas closer to existing development are fragmented, irregular in shape, or adjoin Green Belt zones [3]. The result is a chronic mismatch between housing supply and demand that affects residents across the income spectrum.

For lower-income households, the consequences are most visible in the public rental housing (PRH) system administered by the Hong Kong Housing Authority. As at end-March 2025, about 2.13 million people lived in PRH, while approximately 116,400 general applicant households remained on the waiting list. Both the composite waiting time for subsidised rental housing and the average waiting time for general applicants stood at about 5.3 years, well above the government's own target of around three years [1]. Many of these households live in subdivided flats in the interim, paying disproportionate rents for cramped spaces.

1.2 What Research Shows About the Social Consequences

The link between poor housing and health outcomes is well established in the research literature. A study conducted in Hong Kong found that housing characteristics have a direct impact on residents' mental health, particularly in communities with poor housing conditions such as Sham Shui Po, where the effect operates more directly than in better-housed communities such as Tin Shui Wai [4]. The study used structural equation modelling across two Hong Kong districts and found that the quality of the immediate living environment matters more than neighbourhood-level built environment features for mental wellbeing.

Beyond individual health, the housing shortage shapes broader social attitudes. Hong Kong's exorbitant rents have contributed to political discontent and attracted global concern [5]. Average rents now consume approximately 72% of median monthly income, according to the 2025 Asia Pacific Home Attainability Index, making Hong Kong the second most unaffordable housing market in the region [6]. Households bearing such rent burdens have little capacity to save, invest in education, or absorb economic shocks, reinforcing intergenerational poverty.

1.3 Why Existing Approaches Fall Short

The government has pursued various supply-side measures, including the Lantau Tomorrow Vision reclamation project, rezoning of brownfield sites, and the Light Public Housing programme. These initiatives address parts of the problem but share a common limitation: conventional construction methods are slow and labour-intensive, and Hong Kong's construction sector faces a severe manpower shortage. The magnitude of the manpower shortfall in construction totalled 15,000 in 2023, two-thirds of whom were skilled or semi-skilled workers; this shortfall is projected to triple to 45,000–55,000 by 2028 [7]. A faster, more cost-efficient construction approach is needed to meaningfully reduce waiting times within a policy-relevant timeframe.

2 Technological Proposal

2.1 Overview: BIM Integrated with Modular Integrated Construction

This report proposes the systematic adoption of Building Information Modelling (BIM) combined with Modular Integrated Construction (MiC) for public housing projects in Hong Kong. BIM is a digital process in which a detailed three-dimensional model of a building is created and used to coordinate design, engineering, procurement, and construction across all project stakeholders. MiC involves manufacturing self-contained building modules, complete with interior finishes, fixtures, and fittings, in a factory environment, then transporting and assembling them on site.

Used together, these technologies can substantially compress construction timelines, reduce on-site labour requirements, and improve quality consistency.

2.2 How BIM Transforms the Design and Coordination Process

In conventional construction, design errors and coordination failures between architectural, structural, and building services teams are a major source of delays and cost overruns. BIM addresses this by creating a single shared digital model that all disciplines work within simultaneously. Clash detection algorithms automatically identify conflicts before construction begins, eliminating costly on-site rework [8].

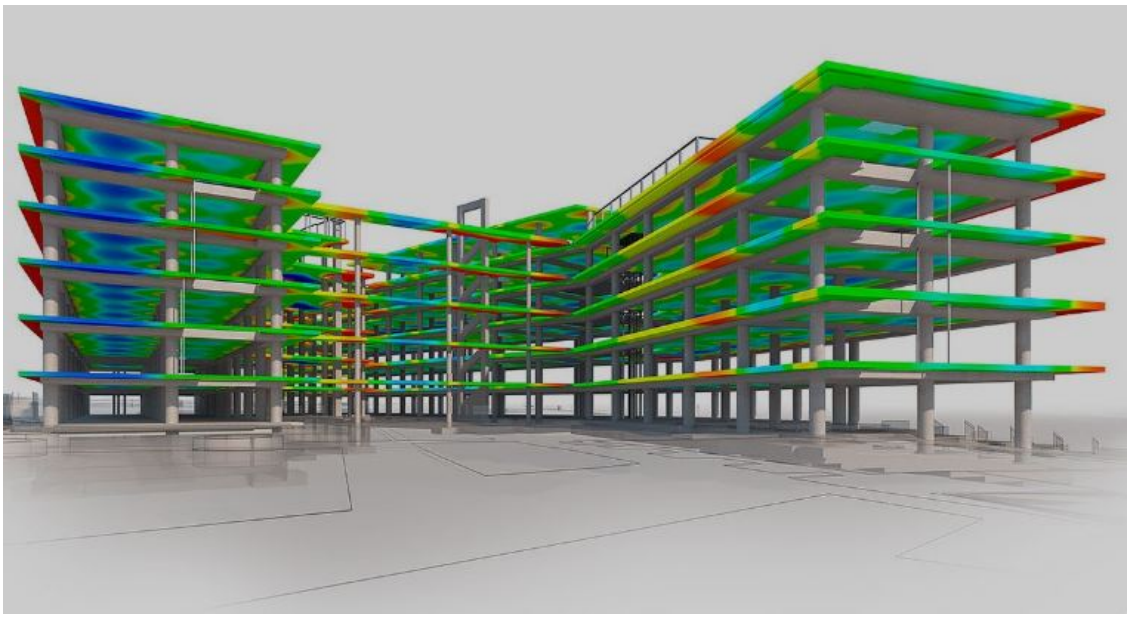

Figure 1: A BIM 3D model of a public housing block showing structural, mechanical, and electrical systems integrated in a single digital environment. *Source: GDI Engineering Design, https://gdiengdesign.com/the-power-of-building-information-modeling-bim/*

For public housing, where designs are often repeated across multiple blocks and estates, BIM enables the creation of standardised parametric models that can be rapidly adapted to different sites. The Development Bureau's Technical Circular (Works) No. 1/2025 sets out the policy and requirements for the adoption of BIM technology across capital works projects, signalling a government-wide commitment to embedding BIM in public construction [9].

2.3 Modular Integrated Construction: Factory Precision at Scale

MiC shifts the majority of construction activity from the building site to a controlled factory environment. Modules are manufactured to precise tolerances, inspected before dispatch, and craned into position on site in a process that resembles assembly more than traditional construction. According to a study by the University of Hong Kong on two completed MiC pilot projects, the adoption of MiC can reduce construction time by about 30 to 50 per cent and save construction costs by about 10 per cent compared with traditional construction methods, with better performance also recorded on productivity, workmanship, environmental protection, and safety [10].

Figure 2: Factory production line for MiC modules, showing completed bathroom and kitchen units being assembled under controlled conditions before delivery to site. *Source: Development Bureau, HKSAR, https://www.devb.gov.hk/filemanager/en/content_1044/20240414_02.html*

Figure 3: On-site crane assembly of MiC modules for a residential building, illustrating the stacking process that replaces conventional floor-by-floor construction. *Source: The Standard, https://www.thestandard.com.hk/news/article/186351/*

For public housing, the implications are significant. A construction time reduction of 30 to 50 per cent directly translates into earlier flat delivery and shorter waiting times for applicants. Factory production also reduces dependence on on-site skilled labour and generates less construction waste and noise pollution in residential neighbourhoods.

2.4 Evidence from Policy Research

Empirical research on BIM adoption in Hong Kong provides direct evidence of its impact. A study using panel data from the Hong Kong construction industry between 2015 and 2021 found that mandatory BIM policy significantly improved both subjective BIM performance and return on investment across key project stakeholders, with the promotion effect growing stronger over time [11]. The study also found that the benefits were not uniform: larger organisations and certain stakeholder groups saw greater gains, suggesting that implementation support for smaller contractors is important.

This evidence base strengthens the case for mandating BIM in public housing procurement, while also highlighting the need for differentiated support mechanisms.

3 Critical Thinking

3.1 Feasibility in Hong Kong's Context

Hong Kong has a strong foundation for this proposal. The Development Bureau's Technical Circular (Works) No. 1/2025 mandates BIM adoption across capital works projects [9], while Technical Circular No. 2/2026 sets out the policy on MiC for new building works with total construction floor area larger than 300 m^2 under the Capital Works Programme [12]. Several completed projects, including the Nam Cheong Street Modular Social Housing Project in Sham Shui Po, demonstrate that MiC is technically viable in Hong Kong's dense urban environment.

The main feasibility constraints are economic and institutional rather than technical. Establishing local MiC manufacturing capacity requires significant upfront capital investment. Currently, almost all building components used in Hong Kong are manufactured in Mainland China [13], which introduces supply chain dependencies and quality assurance challenges. Building a domestic manufacturing base would reduce these risks but requires coordinated investment from government and industry.

Figure 4: Nam Cheong Street Modular Social Housing Project ("Nam Cheong 220"), Sham Shui Po. *Source: CIC MiC, https://mic.cic.hk/en/ProjectsInHongKong/3*

3.2 Counterarguments and Critical Assessment

The most direct counterargument is that BIM and MiC address the speed of construction, not the availability of land. Hong Kong's housing shortage is ultimately a land problem: there is not enough developable land, and the political and environmental obstacles to creating more are substantial. Even if every new public housing block were built twice as fast, the pipeline of approved sites would still constrain total output. Technology cannot substitute for the difficult decisions about land use that have been deferred for decades.

A second concern is cost. MiC requires substantial upfront investment in factory infrastructure and supply chains. For smaller contractors, the capital requirements may be prohibitive, potentially reducing competition in public housing tenders and driving up unit costs. The government would need to consider whether to subsidise factory setup costs or whether the efficiency gains would be sufficient to attract private investment.

There is also a workforce dimension. MiC reduces demand for certain categories of on-site construction labour while creating factory jobs. This transition is not automatic or painless: workers displaced from traditional construction roles may not have the skills or geographic mobility to

take up factory positions. Without active retraining programmes and labour market support, the technology could exacerbate inequality within the construction sector.

Finally, MiC is best suited to buildings with repetitive floor plans, which aligns well with public housing but limits architectural variety. In sites with irregular geometry or complex ground conditions, the efficiency gains may be reduced, and hybrid approaches combining modular and conventional construction may be more appropriate.

3.3 Broader Implications

Beyond its direct impact on housing supply, the adoption of BIM and MiC in public housing could catalyse wider transformation of Hong Kong's construction industry. Demonstrated success in the public sector would build confidence among private developers, potentially accelerating adoption across the industry and generating economies of scale that reduce costs further. The skills and supply chains developed for public housing could also support other infrastructure priorities, including hospitals, schools, and community facilities.

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