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Sustainable Design for Emerging Micro Housing Trends: Architectural Quality and Livability Challenges in Riyadh's Rapid Housing Shift

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Abstract

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The growing Riyadh's housing market is being significantly shifting from traditionally large-family housing units to compact, affordable micro-units. Clearly, due to the influence of Vision 2030-related job growth with high demand for single independent living spaces for expat both genders. Accordingly, converting many two/three-bedroom apartments subdivided into multiple studios. The research aims to highlight the housing challenges of inadequate architectural quality and propose evidence-based recommendations for sustainable occupant-centered design interventions. The research method adopted a qualitative approach. Case study analysis investigating field observation, spatial analysis, and comparative rental data in Riyadh Qairawan district. The discussion reveals concerns in these converted units (poor natural lighting, insufficient ventilation, compromised thermal comfort, and layouts prioritizing profit over livability). The study concludes its findings that unregulated conversions compromise occupant health, well-being, and affordability. Recommendations include design guidelines for the proposed micro-units, considering policies for purpose-built micro-housing developments that balance economic sustainability with architectural quality.

Keywords: Housing Market; Architectural Quality; Sustainable Occupant-centered Redesign; Housing Livability Challenges; Affordable Micro-units.

1. Introduction

1.1 Background

As the capital city of Saudi Arabia, Riyadh has one of the fastest occurring urban transformations in the Middle East. The National Vision 2030 for the Kingdom of Saudi Arabia requires the country to diversify its economy and enhance the quality of life. Riyadh has an immense and immediate need for housing as the country also needs to increase residential density, reduce urban sprawl, and provide sustainable development practices (Klingmann, 2022). These changes have impacted housing demand. This transformation has significantly shifted housing demand away from the city's large, single-family, dominant housing construction that resulted in a household of 4.8 people (Al-Riyadh | Data Saudi, 2022) toward an increasing demand for efficient, affordable, and individually occupied residential units.

In response to these changes Micro housing has developed as a solution to various urban problems related to housing and population density. Micro housing units are residential structures are highly efficient and small, often under 50 square meters, and mainly designed to house single-occupant living. (Zakiyudin & Hasim, 2025). This typology is manifesting in current Riyadh housing market in the informal subdivision of two- and three-bedroom apartments into small studio units due to the high demand for affordable independent living spaces among both male and female expatriate workers. The developments indicate an immediate solution to the growing urban housing affordability crisis; however, the architectural quality of the living units, the wellbeing of the occupants, and the absence of regulatory frameworks of micro housing are of concern. The adoption of micro housing in Riyadh faces challenges beyond spatial and energetic efficiency. Being a desert city, Riyadh has a climate that requires unique architectural approaches. As Alwetaishi (2018) explains, design strategies must take the climate into account. Additionally, Saudi Arabian culture privileges privacy and separation of genders. This creates tensions with micro housing models popular in the West which have compact, open, and flexible designs (Alqahtani & Bahammam, 2024).

There is little to no research in any field that investigates the architectural quality, sustainability, and the occupant-centered design standards within the Saudi framework.

This study attempts to fill this research gap by taking the Qairawan district in Riyadh, Saudi Arabia, as a representative case study demonstrating the city urban extension towards the north, where numerous mega attraction projects, a large concentration of career opportunities, and a growing demand for affordable housing. The study utilizes qualitative research methods combining field observation, spatial analysis, and rental data comparison. The study primarily documents livability challenges in converted micro units, assesses them against sustainable design principles, and offers occupant-centered design recommendations. The research aims to provide balanced solutions for the economic viability and the architectural quality of micro housing. Figure 1 shows the study area in relation to Riyadh.

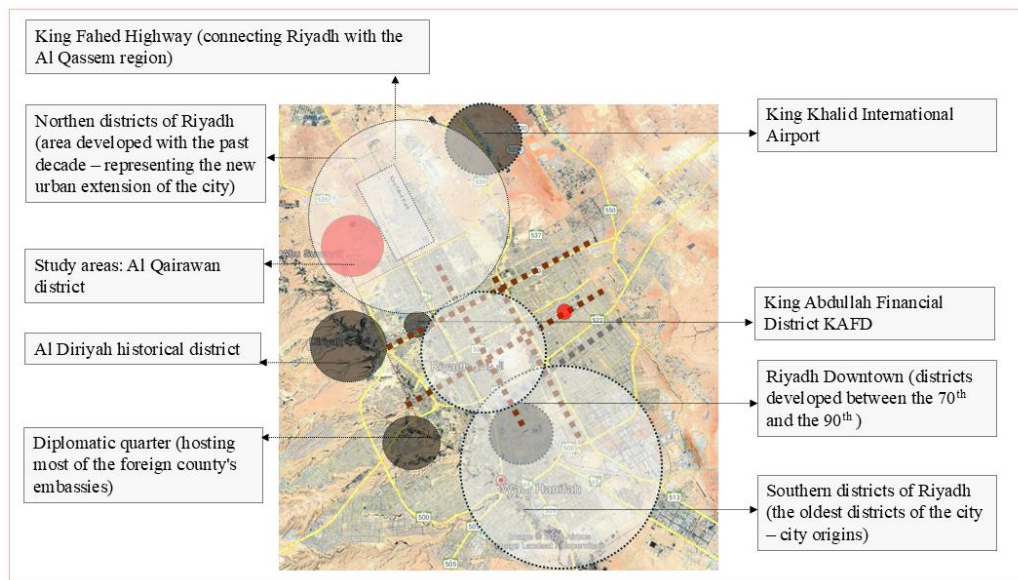


Figure 1. Location of the study area in Riyadh, Saudi Arabia. Source: Prepared by the authors.

1.2 Housing Transformation Under Saudi Vision 2030

Riyadh has fundamentally reoriented its housing market under Saudi Arabia Vision 2030 to address high-demand, affordable, and sustainable housing solutions. Increased homeownership and improved quality of life balance have changed housing demands within the city, creating conditions that support the emergence of micro-housing trends. The focus on improving quality of life and increasing home ownership is evident in the shift from traditional housing units to the demand of micro housing. The vision's focus on promoting economic diversification has led to the creation of multiple job opportunities that have started to draw an increasing number of local and foreign workers to Riyadh (A. Alqahtany, 2020). According to Alhefnawi et al. (2023), Riyadh's population is expected to reach 16.5 million by 2030. This population increase will put pressure on the city's housing sector, requiring 2.6 million housing units to accommodate the new residents. Additionally, the housing sector is expected to be short of 1.37 million units, a deficit that is equal to 108% of Riyadh's housing stock in 2020, creating a significant quantity shortfall. This pressure is not only quantitative. Alhajri, 2022 notes that rapid population growth, urbanization, and building costs influence the capacity of the housing market to meet housing demand.

The evolution from traditional housing for large families to smaller housing units corresponds with changes in demographics. According to Klingmann (2022) regarding the urban mega projects of Riyadh, designers intend to create all-inclusive lifestyle arrangements for the residents of the projects while also focusing on attracting foreign investors, which creates a demand for various housing types, including smaller and more affordable housing units designed to accommodate single professionals and expatriate employees. The demand for housing and the lack of affordability, coupled with regulatory gaps, has created a micro-housing typology as a solution.

1.3 Housing Affordability Crisis and Policy Challenges

Affordable housing in Riyadh is a well-known problem in literature. A. Alqahtany (2020) mentions four main problems that contribute to the inability to provide affordable housing: housing shortages, high housing costs, demographic changes, and land scarcity. Gazzeh (2025) shows that there have been some improvements in rental pricing between 2020 and 2023, yet the rental market is still mostly inaccessible for prospective tenants, especially for expatriate communities, who have limited ownership options. These conditions give property owners the incentive to maximize rental income by subdividing apartments, despite the impact of these conversions on the quality of the buildings and their livability. A. M. Alqahtany and

Alshammari (2025) state that, even with the implementation of policies such as the Sakani and Idle Lands programs, a vast amount of policy gaps is present, and even with policy improvements, the problems described in the literature will remain. Current policies, based on literature, do not seem to regulate subdivisions among micro-housing and do not attempt to regulate micro-housing development and/or conversion policies. Alarabi (2026) states that new households in Riyadh want housing that is located in the city center, and value having access to employment and other city amenities more than the size (or the number of rooms) of their housing units. This desire is in direct contrast with the focus of developers, who have largely invested in the construction of high-end residential housing in the suburbs and in residential housing in the city outskirts. The structural gap between what households want and what developers provide is the basis for the numerous subdivisions and conversions of micro-units in Riyadh housing market. Table 1 and Figure 2 show the market trends for context.

Table 1. Residential Rent Indicators for Alqairawan District -Price Comparison (2020-2025).

Source: Aqar website, prepared by the authors.

Year	Half-Year	Period	1 Bed (SAR)	2 Bed (SAR)	3 Bed (SAR)	Spread (SAR)	Average (SAR)
2020	H1	First Half 2020	19,455	25,570	26,095	6,640	23,707
2020	H2	Second Half 2020	19,290	27,030	32,110	12,820	26,143
2021	H1	First Half 2021	19,985	29,755	40,140	20,155	29,960
2021	H2	Second Half 2021	26,665	34,015	44,785	18,120	35,155
2022	H1	First Half 2022	30,045	43,205	60,340	30,295	44,530
2022	H2	Second Half 2022	31,580	44,800	56,185	24,605	44,188
2023	H1	First Half 2023	33,785	48,620	58,520	24,735	46,975
2023	H2	Second Half 2023	36,750	52,395	61,060	24,310	50,068
2024	H1	First Half 2024	41,180	59,105	68,500	27,320	56,262
2024	H2	Second Half 2024	36,395	58,935	67,825	31,430	54,385
2025	H1	First Half 2025	34,210	59,570	72,035	37,825	55,272
2025	H2	Second Half 2025	33,830	58,595	66,765	32,935	53,063

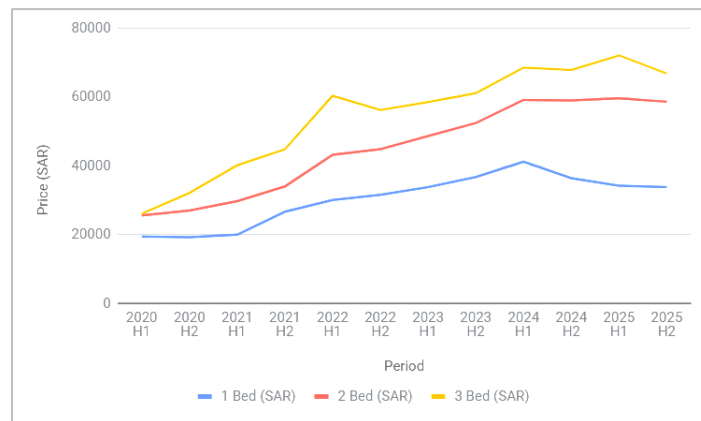


Figure 2. Residential Rental Price Trends in Alqirawan (2020-2025). prepared by the authors.

1.4 Architectural Quality and Environmental Sustainable Design Concerns

Increased housing supply has caused a growing concern regarding the quality of housing and residents' well-being. Mnea & Zairul (2022) note housing design process deficiencies and minimal association between design and community needs. Their thematic analysis identifies gaps of knowledge and practices oriented towards the design of housing interiors that do not resolve social, financial, and sustainable challenges related to quality housing in KSA.

There is a significant body of work that discusses the challenges of sustainability for compact housing with the most challenging contexts being micro housing (Nasreldin, R., & Abdelfattah, D., 2025). With regard to the small housing units, there is a significant body of work that discusses the importance of cross ventilation, passive strategies to assist with thermal comfort, and the role of natural daylight. Some of the work also discusses the passive design strategies in the example of dry and hot climates. Khoukhi et al. argue that "openings in the building envelope are essential in an active design process" and also stress that natural ventilation is a key strategy for comfort in no longer the natural comfort zone. They note that, in hot

and humid climates, controlled ventilation and natural cooling are essential to achieving the desired comfort conditions in buildings. They also stress the critical role of building form, orientation, and the selection and performance of building envelope materials, which have a significant impact on energy consumption.

Najjar et al. (2025) illustrate important issues that face the Indoor Environmental Quality (IEQ) of buildings in Saudi Arabia and the impact on the well-being of occupants from inadequate natural lighting and the lack of even distribution of lighting in buildings. These issues are even more pronounced in micro housing where there is inadequate space which further limits the opportunities to provide adequate ventilation and natural lighting.

1.5 Cultural and Social Sustainability Considerations

Saudi Arabian housing design must address social and cultural factors that are often neglected during profit-driven contexts. Alqahtani & Bahammam (2024) advocate for the preservation of social and cultural sustainability in Saudi housing, stating that housing developments capture the culture and the social aspects of the Saudi community. The rapid economic changes have led to the adoption of western architectural practices that disregard the region's culture and identity, both socially and environmentally (Fardous et al. 2019). This is particularly the case for micro-housing trends that compromise cultural context and environmental sustainability for economic reasons. Alnaim (2022) analyze the changing housing forms in Saudi Arabian cities and how building policies regarding privacy, gender segregation and hospitality have formulated the spatial arrangements and social structures of society. The transition of large family- oriented apartments into individual micro-units may worsen the defined environmental deficiencies, social problems, and cultural, hospitality practices.

Privacy in the Saudi Culture is a social requirement as well as a spatial one. Rooms and circulation should be organized in a suitable way to prevent direct overlooking; public and family domains should be separated, and façade openings should be well controlled. Al-Hemaidi (2001) found that overlooking neighboring villas reduced use of yards and drove residents to add extra fences and shutters, which is a strong signal that micro-units in dense settings need visual buffers and setback control. Similarly, Al Qhtani (2009) found that residents in Riyadh associated good privacy with insulation of internal and external walls, reflecting glass, and clearly defined reception and living spaces.

Research Gaps
While the research provides ample context to the understanding of the issues of housing in Riyadh, there remains a significant gap in micro-housing trends. There has been almost no research on the segmentation of larger apartments into micro-units, the design shortcomings in such segmentation, and the effects on the health and the well-being of the occupants. The case study on the Qairawan district provides original research to fill this gap. The research literature also provides almost no direction on the regulation of micro-housing, especially on quality standards. Hence, the policy suggestions from this research will be the first of their kind.

1.6 Research Objective

The purpose of this research is to examine architectural livability of an illustrative sample of transformed micro-housing units in Qairwan district of Riyadh. The examination will focus on the spatial configuration, functionality, and access to daylight and natural ventilation, in addition to privacy. This will be achieved through an observational assessment of 8 micro-units, examining how the informal subdivision affects the architectural quality of the units. The findings will be used to propose evidence-based design and policy recommendations for micro-housing units that are more context-sensitive and livable in Saudi Arabia.

1.7 Study Significance and Contribution

This study examines a particular kind of housing provision in Riyadh that has not been extensively documented so far: the informal conversion of existing apartments into micro-housing. While micro-housing is a rapidly developing response to the changing and growing needs of households in the context of housing market pressures and affordability, frameworks for assessing micro-housing in Saudi Arabia in terms of architectural quality, environmental performance, and socio-cultural appropriateness are absent. By investigating the Qairawan district, this study fills the gap in literature and provides evidence on the livability, sustainability, and design of privacy and space for occupants that converted housing units can provide. The study identifies a range of design shortcomings of informal room partitioning and uncontrolled subdivision in housing practice, and places signs on micro-housing development in Saudi Arabia that is more sustainable and sensitive. It is believed that the results of the study will have a positive impact on micro-housing design and housing policies in Saudi Arabia.

2 Materials and Methods

The research methodology has adopted the qualitative research approach, incorporating a descriptive review of relevant scholarly literature. To study the developing micro housing trend in the Qairawan district of Riyadh, a case study method was employed. The case study method is ideal for examining complex, contemporary problems within their real-world context.

2.1 Study Design and Setting

The Qairawan district was selected as the study setting due to its representative characteristics of the new northern expansion of Riyadh and the evolving housing market. The district hosts three private universities including Al Yamamah, Al Enaya, and Al Marafa universities. Having such educational institutions in the area contributes to drawing the younger generation, i.e., university students, from Riyadh city and the nearby region, together with local and international employees, including administrative staff and even academics and professors. There is no provision of on-campus dormitories for the above-mentioned categories, the type of housing needed within the neighborhood has changed to fulfil the users' needs. According to the new requirement, a major shift was observed from a conventional large family unit to small unit housing or micro-unit studio phenomena. Taking into account the new demographics and economy of Riyadh, linked to the implementation of the Vision 2030 program, more people have started moving to Riyadh, seeking for job opportunities (Alkhresheh, M. 2025). The study design incorporates multiple data collection methods to ensure a comprehensive understanding of the micro-housing phenomenon. Following the qualitative methods approach, the study applies field observations, spatial analysis, and comparative data analysis to triangulate findings and enhance validity. The qualitative design allows for in-depth exploration of architectural quality issues that might be lacking within quantitative approaches.

2.2 Participants or Subjects

The study focuses on converted micro-housing units in the Qairawan district rather than individual human subjects, aligning with the building-centered context. A total of eight housing units were selected for detailed analysis. The case study included converted apartment units that have been subdivided from original two or three-bedroom configurations into multiple studio units. The selection process was based on purposive sampling to ensure that the units represented a diverse range of configurations, sizes, and conversion qualities. The criteria for selecting the housing units were as follows:

Recency of Conversion: Only apartments that were converted into micro-units within the last five years were included to ensure the relevance of the findings to current market trends.

Target Population: Units targeting single occupants, including expatriate workers, were prioritized, as they represent the primary demographic driving demand for micro-housing.

Accessibility: Properties that were accessible for detailed spatial assessment were chosen to allow for comprehensive on-site observations and measurements.

2.3 Materials and Equipment

During case study analysis, various measurement, documentation, and analytical tools are employed to capture and analyze data. Digital cameras are used to document and assess the spatial relations of different configurations, the lighting, and the changing architectural elements. Laser distance meters and digital calipers aid in measuring room dimensions and ceiling heights as well as the window-to-floor area ratio. Environmental observations were made to assess general conditions related to natural lighting, ventilation, and thermal comfort. Observations of airflow patterns, window placement, and the presence of natural light were recorded qualitatively to identify potential deficiencies in environmental performance. The analysis was based on visual inspections and subjective assessments of the units' environmental conditions rather than quantitative measurements.

These tools evaluate the environmental concerns demonstrated by the observation. Documentation materials assist researchers in developing and maintaining uniform data collection across case study units. Digital aids like Computer-Aided Design (CAD) and spatial documentation and analysis do case study research. Property and building rental market value in a specific location is obtained from building and rental websites, a real estate database, and local market reports, documenting each comparative analyses of converted and non-converted units.

2.4 Procedures and Protocols

This research employs a modular, three-step data collection process to conduct a consistent, thorough, and systematic case study across eight housing units. The number of units was determined based on the need for a manageable yet diverse sample size that could provide sufficient depth for qualitative analysis while being representative of the micro-housing trend in the Qairawan district. Phase One consists of district-level mapping and preliminary identification of converted properties via a visual survey and rental market evaluations. During this phase, the preparatory scope of the conversion and range of representative case study units are identified for subsequent analysis.

Phase Two consists of visits to directly observe the converted units. The visits were conducted in April of 2026. Each visit was 30 minutes in the afternoon and included a survey of spatial features, area, circulation elements, natural ventilation, daylight, and the comparison of the conversion to the original configuration when possible. The visits also included observations of perceived safety and privacy levels.

Phase Three consists of a contrastive analysis of the converted units. The spatial analysis protocol measures room dimensions, ceiling heights, window areas, and circulation spaces to calculate space efficiency ratios and compare converted units to original apartment configurations. Environmental assessment protocols measure natural light levels at multiple points within

each unit, observe temperature and humidity variations, and assess ventilation adequacy through air movement observation . Social and cultural protocol addresses the intangible factors of sense of safety and privacy. Phase Three involves comparative analysis between converted units and control cases of non-converted apartments in similar buildings. This comparison enables identification of specific design deficiencies resulting from conversion processes rather than general building quality issues. Rental data analysis compares pricing per square meter between converted and non-converted units to assess economic implications of conversion practices.

2.5 Data Analysis

Although the study incorporates some quantitative measurements (e.g., spatial dimensions and environmental indicators), the overall approach employs thematic analysis techniques to identify patterns and themes across multiple case study units. The qualitative data will mainly consist of "case studies". Comparisons and reviews of similar studies will be used as supportive evidence. The qualitative data will be used mainly to interpret and understand specific phenomena. The type of qualitative data will be limited in order to prevent an overwhelming amount of subjective data in relation to the quantitative data. The analytical approach, which includes space efficiency ratios, natural lighting adequacy, and ventilation performance indicators. The environmental data analysis synthesizes findings across spatial, environmental, and economic dimensions to develop a comprehensive understanding of micro-housing quality challenges. Cross-case comparison identifies both common problems and variations in conversion quality, enabling the development of targeted design guidelines and policy recommendations that address the variety of conditions found in the Qairawan district case study. Environmental data analysis uses sustainable design criteria to defined requirements for residential indoor environmental quality. Lighting levels are studied in accordance with worldwide standards for residential spaces. In order to create a thorough understanding of the issues associated with micro-housing quality, the research synthesizes information across spatial, environmental, and economic aspects. In order to produce specific design guidelines and policy recommendations that address the range of conditions found in the Qairawan district case study, cross-case comparison is used to identify both common issues and variances in conversion quality.

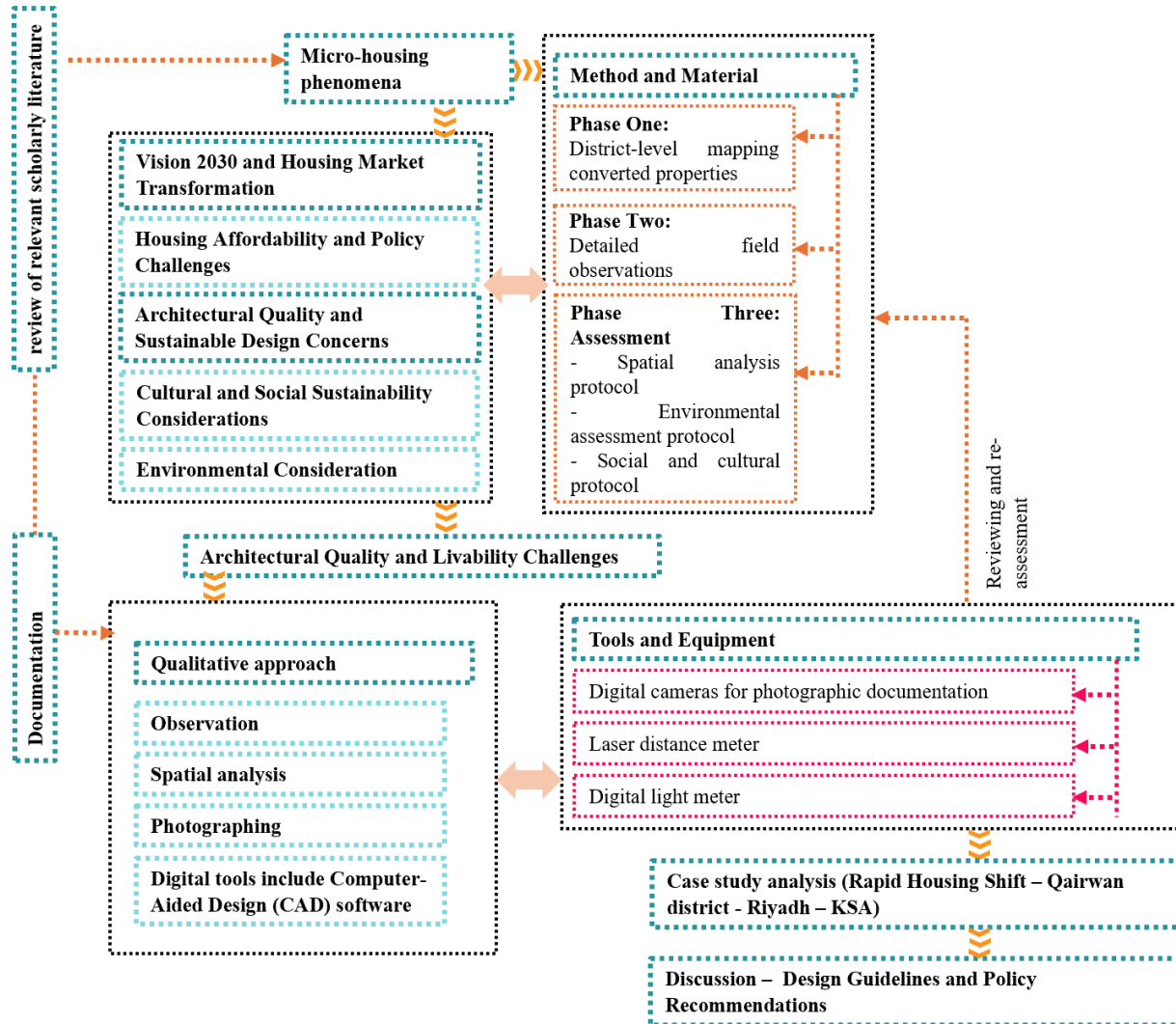
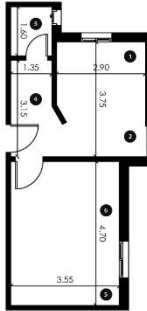
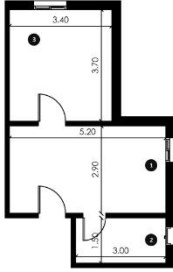
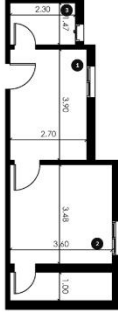


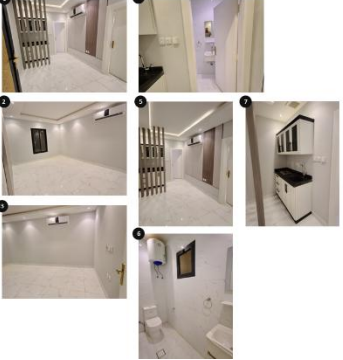
Figure 3. Material and Method.

2.6 Case Study

Riyadh, the capital of Saudi Arabia, is going through urban and economic changes in response to the northern extension of Saudi Arabia's urban and cultural regions (Abdelfattah, D. et al. 2025). The Qairawan district, which is in the Saudi capital's northern expansion, is experiencing rapid changes as it develops close to new transport infrastructure and new educational institutions such as Al Yamamah and Al Enaya and Al Marafa universities, etc. The Qairawan district will also host the growing demand for several housing types for the students, instructors, and experts of the new universities. For the above reasons and some more, the Qairawan district is a figurative 'living laboratory' for the micro housing movement. As the larger residential apartments of the area give way to the smaller studios, providing a valuable example of how Riyadh's housing market is adapting to the demand of rapid urban growth and changing residential needs. To examine this emerging trend, this study selected eight micro-housing units as representative case studies from a larger population of similarly transformed units in the area. The selected units are located in residential buildings strategically situated near major universities and within convenient access to the SAB Metro Station, making them particularly relevant for investigating the role of micro-housing in meeting the accommodation needs of the district's growing academic and professional population. Table 2 shows the 8 selected units.

Table 2 Selected units.

Criteria	Info	Documentation	
Name (area)	Unit 1 (34.4 sqm)		     
Spatial configuration	Bedroom + living room + kitchenette + bathroom		
Bedroom size	4.70 x 3.55 m		
Living area size	3.75 x 2.90 m		
Kitchenette condition	1.35 x 1.5 m; by entrance; cabinets, countertop, sink, electric stovetop		
Bathroom condition	1.4 x 1.35 m; toilet, sink, showerhead, bidet spray, water heater; small window		
Daylight/openings	Bedroom, living room, and bathroom windows; all open to lightwells		
Ventilation	Lightwell-facing windows		
Privacy/layout issue	Kitchenette next to entrance		
Key livability concern	Lightwell-only outlook; compact kitchenette and bathroom		
Name (area)	Unit 2 (32.4 sqm)		  
Spatial configuration	Bedroom + living room with kitchenette + bathroom		
Bedroom size	3.70 x 3.40 m		
Living area size	5.20 x 2.90 m		
Kitchenette condition	In living room; cabinets, countertop, sink, backsplash		
Bathroom condition	Tiled; toilet, sink, showerhead, bidet spray		
Daylight/openings	Bedroom and living room windows		
Ventilation	Windowed bedroom/living room		
Privacy/layout issue	Kitchenette in living room		
Key livability concern	Bathroom size not stated; kitchenette integrated into living space		
Name (area)	Unit 3 (30.4 sqm)		  
Spatial configuration	Bedroom + living room with kitchenette + bathroom		
Bedroom size	3.48 x 3.60 m		
Living area size	3.90 x 2.70 m		
Kitchenette condition	In living room; cabinets, countertop, sink, backsplash		
Bathroom condition	1.47 x 2.30 m; toilet, sink, showerhead, bidet spray, water heater		
Daylight/openings	Bedroom and living room windows		
Ventilation	Windowed bedroom/living room		
Privacy/layout issue	Kitchenette in living room		
Key livability concern	Compact living room and integrated kitchenette		

Name (area)	Unit 4 (44.77 sqm)	 
Spatial configuration	Bedroom + living room + kitchenette + bathroom	
Bedroom size	2.95 x 4.70 m	
Living area size	4.20 x 4.60 m	
Kitchenette condition	By entrance; cabinets, countertop, sink, backsplash	
Bathroom condition	1.55 x 2.05 m; toilet, sink, showerhead, bidet spray; small window	
Daylight/openings	Bedroom, living room, and bathroom windows	
Ventilation	Windowed bedroom/living room/bathroom	 
Privacy/layout issue	Kitchenette next to entrance	
Key livability concern	Entrance kitchenette; bathroom compact	
Name (area)	Unit 5 (69.27 sqm)	
Spatial configuration	Two bedrooms + living room + kitchen + bathroom	
Bedroom size	4.78 x 3.33 m; 4.78 x 3.80 m	
Living area size	3.32 x 4.9 m	
Kitchenette condition	Kitchen 4.94 x 2.25 m; cabinets, countertop, sink, backsplash, water heater	
Bathroom condition	Tiled; toilet, sink, showerhead, bidet spray; small window	
Daylight/openings	Bedrooms, living room, and bathroom windows	
Ventilation	Windowed bedrooms/living room/bathroom	
Privacy/layout issue	No clear privacy issue stated	 
Key livability concern	Larger layout; no major livability concern stated	
Name (area)	Unit 6 (29.83 sqm)	
Spatial configuration	Bedroom + living area with kitchenette + bathroom	
Bedroom size	3.86 x 3.20 m	
Living area size	3.98 x 3.57 m	
Kitchenette condition	Within living area; lower cabinets, countertop, sink, backsplash	
Bathroom condition	1.10 x 1.00 m; toilet, sink, bidet spray, water heater; very compact	
Daylight/openings	Bedroom and living area windows	
Ventilation	Windowed bedroom/living area	 
Privacy/layout issue	Kitchenette within living area	
Key livability concern	Limited kitchenette components; no upper cabinets stated	
Name (area)	Unit 7 (32.35 sqm)	
Spatial configuration	Bedroom + living area + kitchenette + bathroom	
Bedroom size	3.46 x 5.32 m	
Living area size	2.65 x 2.84 m	
Kitchenette condition	By entrance; cabinets, countertop, sink, backsplash	
Bathroom condition	Tiled; toilet, sink, showerhead, bidet spray, water heater	
Daylight/openings	Bedroom window only stated	
Ventilation	Living area opening not stated; bedroom window stated	
Privacy/layout issue	Kitchenette next to entrance	
Key livability concern	Very small bathroom; limited stated daylight beyond bedroom	

Name (area)	Unit 8 (14.97 sqm)	
Spatial configuration	Studio + kitchenette + bathroom	
Bedroom size	Main room 4.95 x 3.12 m; additional width 3.40 m at upper section	
Living area size	Same as main room	
Kitchenette condition	By entrance; cabinets, countertop, sink, backsplash, cooktop	
Bathroom condition	1.40 x 1.58 m; toilet, sink, showerhead, bidet spray, mirror, water heater	
Daylight/openings	Main room window	
Ventilation	Windowed main room	
Privacy/layout issue	Kitchenette next to entrance	
Key livability concern	Very small studio area; compact bathroom	

3. Results

The apartments follow a recurring pattern of subdividing spaces to accommodate the maximum number of rental units possible within an existing building. Although the resulting spaces may be large enough for basic habitation, the designs of these spaces highlight major compromises for other aspects such as privacy, comfort, and overall building performance. The spaces are designed for short-term stay rather than long-term habitation.

Most of the apartments are designed to be a room-based unit that contains a small kitchen and a small bathroom. Although the bedrooms are large enough and have adequate finishes, adequate lighting, and adequate air conditioning, this may conceal the inadequacy of other supporting spaces. The bathrooms are small in proportion to the size of the whole apartment and the living rooms are sometimes absorbed by the circulation zones. This suggests that the amount of rentable room area has the highest priority, sacrificing livability in the process.

The reduced functionality is best illustrated by the kitchenettes. In many apartments, the kitchenette consists of a cabinet with no usable countertop or very limited countertop space for food preparation or drying dishes. In many designs, there is insufficient room to open the cabinets and drawers without turning sideways to do so, and, in most, the kitchenette is so small that it does not have enough space to accommodate a full-size refrigerator or a built-in small refrigerator. As a result, the kitchenette becomes a token amenity rather than a functional space. Another issue is the location of the kitchenette. In some apartments, the kitchenette is situated directly next to the entrance and/or the bathroom door, which raises both hygiene and functionality concerns.

Another issue is the lack of proper ventilation. Since in most cases the kitchenettes are located in the internal spaces of the apartments, and not along the exterior walls, combined with the small unit size, the absence of proper mechanical ventilation, and the kitchenette being next to a shared foyer and/or corridor, the cooking smells traverse the entire building. The problem then is no longer internal, but external, affecting other residents and visitors.

The arrangement causes an unequal distribution of natural lighting. Even though there are windows in all the bedrooms and in most of the living rooms, the secondary spaces and the circulation areas are often left without natural lighting.

Multiple apartment units open into the central apartment's foyer and corridors, and the entry doors face one another at distances of only 120 cm in some cases. Such arrangements have a negative impact on the sense of domestic privacy that one would normally expect from a non-shared residence.

At the building scale, splitting larger apartments into smaller units increases density without expanding the services and infrastructure. Parking, water supply, elevators, and waste management become strained. Residents often complain about these issues in reviews.

The economic rationale for subdividing larger apartments is that the smaller units can generate as much as 150% of the rental income of the original unit. The results of unplanned subdivision can lead to a large increase in density, loss of quality of housing supply with diminished performance, a loss of privacy, and a loss of housing quality.

The subdivision of larger units into smaller units is intended to increase building occupancy. Most of the smaller units are not adequate for occupancy because they do not meet the performance requirements needed for long-term occupancy. The main result of this form of subdivision is a large increase in the absolute quantity of housing that is supplied, a large decrease in the quality of the housing that is supplied, and a loss of privacy and amenity.

Table 3 shows a cross-unit comparison. The architectural quality of the units is not equal. Unit 5 performs the best due to the larger area. Units 2, 3, and 6 were intermediate, with the main issue being that the kitchenette was absorbed into the main living space. Units 1, 7, and 8 showed the most severe degradation in architectural quality, with limited access to daylight and natural ventilation and the kitchenette being located at the unit entrance. Overall, the architectural quality of the units depends on the layout, services location and area, and access to daylight and natural ventilation.

Table 3. Comparison of the 8 Selected Units.

Indicator	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
Unit area	34.4 sqm	32.4 sqm	30.4 sqm	44.77 sqm	69.27 sqm	29.83 sqm	32.35 sqm	14.97 sqm
Separate bedroom	Yes	Yes	Yes	Yes	Yes, Two	Yes	Yes	No
Kitchenette by the entrance	Yes	Yes	Yes	No	No	Yes	No	Yes
Kitchenette in the living space	No	Yes	Yes	No	No	Yes	Yes	No
Very compact bathroom	No	No	No	No	No	Yes	No	No
Windows in habitable rooms	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lightwell only access	Yes	No	No	No	No	No	No	No
Overall design quality	Lower	Medium	Medium	Medium	Higher	Medium	Lower	Lower

4. Discussion

4.1 Interpretation of Key Findings

The study of micro-housing in the Qairwan district of Riyadh shows how the Qairwan housing market fails to provide the architectural quality required for the safe and healthy habitation of occupants, and led to a significant compromise in quality and livability. The most important conclusion suggests that the singular division of larger apartments into micro-units prioritizes maximizing economic return as the market trend shows that the increase in rent for a 3 bedroom unit is lower than the combined increase in a 1 bedroom and 2 bedroom units. Riyadh's housing shift prioritizes quality and affordability and creates a burden for its residents. The increase in housing density addresses the quantitative housing shortage in Riyadh, the qualitative aspects of these units (such as poor ventilation, inadequate natural lighting, and compromised privacy) highlight a failure to align with sustainable and occupant-centered design principles.

The discovery of multiple unit bathrooms and kitchenettes indicates a severe degradation of domestic life. The arrangement of a bathroom next to a kitchenette and the entrance also creates a health and safety concern. In addition, the lack of natural light in secondary spaces and the loss of acoustic and visual privacy due to the inadequate and unplanned circulation of spaces encourages a home to become a high stress and unhealthy environment. The findings suggest that micro housing partially addresses the market's needs, but it fails on a qualitative level and may produce poor urban resilience and threaten occupant health. Points can be outlined as follows:

The informal conversion pattern is interpreted as a predictable structural outcome when formal supply fails under affordability pressure (Alqahtany & Alshammari, 2025). The 150% rent premium is recast as the economic driver that rationalizes quality sacrifice, not just a standalone finding. Environmental deficiencies (lightwell access, absent ventilation, undersized bathrooms) are explained as the logical result of treating passive performance as residual rather than a design constraint, directly contradicting the theoretical framework of the literature review (Nasreldin, 2025). The privacy failures (120 cm inter-door gaps, kitchenettes at shared entries) are interpreted as the dismantling of Saudi spatial grammar (Alnaim, 2022; Alqahtani & Bahammam, 2024), creating cultural unsustainability alongside environmental failure.

4.2 Comparison with Previous Studies

The results reinforce and extend the concerns raised in recent literature regarding the structural transformations in the Saudi Arabian housing sector. The potential increase in density is aligned with the concerns addressed by Alhefnawi et al. (2023) in the context of the massive housing shortfall that Riyadh is predicted to encounter with respect to Vision 2030. However, while Klingmann (2022) places emphasis on the positive side of urban megaprojects with respect to the enhanced quality of life, the empirical findings of the research indicate that, at the neighborhood level, informal market mechanisms that dominate are likely to be decreasing quality of life for a substantial part of the population. The research remarks about the environmental qualities and the lack of adequate natural light and natural ventilation, serve to validate the observations made by Najjar et al.

(2025) and Khoukhi et al. (2020) regarding (IEQ) in hot-arid regions. The case study illustrates that when housing units are subdivided without proper design interventions, passive cooling and lighting are adversely affected. The social conflict that exists between the compact micro-unit low-density housing and the preferences of the Saudi Arabian culture for housing that contains a high level of privacy is discussed by Alqahtani & Bahammam (2024). It is shown that unit doors in the housing units of Qairawan case study are constructed at a distance of 120 cm, which affects the core element of the Saudi Arabian culture of privacy.

4.3 Strengths and Limitations

A key strength of this study is its localized, empirical analysis of the Qairawan district of Riyadh city. This goes beyond the high level policy discussions that dominate most of the Saudi Arabia housing research. The flexible, qualitative, mixed-methods approach of field observation, spatial measurement, and the triangulation of rental data will provide characterization of the micro-housing phenomenon. Yet, this study is limited by its geographical constraint of a single district in Northern Riyadh. Although Qairawan is a representative sample for such phenomena, due to its proximity to universities and job opportunities, the research findings may not represent the full spectra of micro-housing shifts in centrally located, older Riyadh districts.

4.4 Implications and Future Directions

There are important implications of this study on urban policy and architectural practices in Saudi Arabia. MOMRAH (for the Ministry of Municipal and Rural Affairs and Housing) urgently needs to develop new policy and regulation on "purpose-built" micro-housing. The new policy should not just apply penalties on informal subdivisions. Instead, it should offer a path to legalization. This can be accomplished by establishing requirements and standards for the appropriate levels of ventilation, the minimum ratios of window floor area to room floor area, and sound isolation requirements. The study also offers insight to architects on the importance of sustainable, occupant-centered design. Examples of this type of design knowledge include replacing the simple division of rooms with the use of modular, highly efficient systems that allow for the integration of furniture and that optimize counter space and storage without occupying the valuable floor space. Research on design options for co-living housing should be prioritized. This design will create units that offer large shared living, cooking and laundry space and amenities, and that also offer a small, private living space. The design will offer a more environmentally sustainable housing option than the existing studio housing options. The design will also be culturally sustainable, and offer a more integrated living space than what currently exists in the city.

5. Conclusion and Recommendations

5.1 Summary of Key Findings

This study has investigated emerging micro-housing units in Riyadh and their potential to address housing shortages and demographic changes under the Vision 2030. Research conducted in the Qairawan neighborhood established that the market has responded positively to the demand for high-density and affordable housing by sub-dividing large apartments. However, this has been done at a significant qualitative compromise. Some of the converted units were found to have hardly any natural light, internal kitchenette spaces with hardly any ventilation, and a drastic reduction in visual and sound privacy. It was found that 'profit-driven' designs compromised the basic infrastructure and services of the units for short-term stays, but lack the habitability required for long-term residency.

5.2 Implications of the Findings

The findings carry substantial considerations for the urban living in Saudi Arabia. First, in case the phenomena continued without intervention, there is a possibility for the micro housing trend in Saudi Arabia to create housing units of low quality and pose long-term health and social risks to occupants. Second, the idea of traditional Saudi privacy and safety, and the flexibility of Saudi high-density housing, shows the demand for designing spaces oriented to develop a Saudi Micro Typology. Third, the fact that the housing market favors conversion of housing units to provide 150 percent more rental income than the original housing units, creates urgency for city planners, and municipal authorities, to focus on the establishment of housing quality controls regulations.

5.3 Limitations of the Study

This study focuses on recent neighborhoods near universities in the Qairawan district, and is therefore limited in both its sample size and geographical scope. The results are likely to be different when applied to more established districts in Riyadh, where different architectural ages and structural constraints are found. In addition, this study limited its focus on the quality of the architectural and environmental aspects, and did not incorporate the psychological well-being of the residents in the long term, the costs of maintaining the high-density subdivided buildings in the long term, and the effects of high-density subdivided buildings on the urban environments in the long term.

5.4 Recommendations for Future Research and Policy

To address the challenges identified, the following strategies and guidelines are proposed:

5.4.1 Design Guidelines for Micro-Housing

Based on the observed lack of adequate natural lighting in many of the analyzed units, it is recommended that habitable rooms have a minimum window-to-floor area ratio of 10% to ensure sufficient natural light penetration.

To address ventilation issues documented in units with internal kitchenettes and bathrooms, all kitchenettes and bathrooms should have external ventilation or, where this is not feasible, a high-powered mechanical extraction system must be installed. Acoustic and Visual Privacy: Evidence from the study highlighted privacy concerns due to facing doors and inadequate sound insulation between units. To address this, new regulations should require a minimum distance of 200 cm between facing doors in shared corridors and establish minimum standards for wall thickness and sound insulation materials.

Modular Efficiency: Observations revealed that many kitchenettes lacked sufficient countertop space, storage, or functional layouts. Modular and multi-functional furniture systems should be incorporated into micro-housing designs. For example, foldable tables or wall-mounted storage solutions can optimize space without compromising functionality.

5.4.2 Policy and Regulatory Strategies

Micro-Units and MOMRAH: MOMRAH should develop a specific licensing category for Purpose-Built Micro-Housing, with clear guidelines for design, construction, and environmental standards. This would incentivize developers to create micro-housing that meets adequate standards rather than resorting to unregulated subdivisions.

Building Code Changes: The study found that unregulated conversions often strain building infrastructure, such as parking, water supply, and waste management. Building codes should be revised to require that services and infrastructure (e.g., parking spaces, waste disposal systems, and elevators) are designed to accommodate the maximum potential number of units within a building, rather than being based on the original configuration.

Subsequent Investigations: Further studies should examine co-living models as a viable alternative to informal micro-housing conversions. Co-living arrangements could provide shared living, cooking, and laundry spaces while offering private bedrooms, ensuring a balance between affordability, environmental sustainability, and cultural appropriateness.

Future research should also investigate the long-term psychological and social impacts of micro-housing on residents, particularly expatriates and young professionals, as these groups are the primary occupants of such units.

Additionally, the economic and environmental implications of high-density micro-housing developments on urban infrastructure and services should be explored to inform future urban planning and policy decisions.

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