Correlation Between Quality of Housing and Resident Satisfaction: A Study of High-Rise Low-Cost Housing in Penang

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Abstract

As urbanization accelerates and housing demands rise, understanding the relationship between housing quality and resident satisfaction is essential to improving living conditions for low-income communities. In Penang's high-rise, low-cost housing, growing dissatisfaction among residents is often attributed to poor design quality, leading to overcrowded living spaces, inadequate facilities, and a diminished quality of life. While previous studies have focused on affordability and basic living conditions, this research emphasizes the critical role of housing design quality in shaping resident satisfaction and well-being. This study investigates the correlation between housing quality (HQ) and housing satisfaction (HS) in high-rise, low-cost housing developments in Penang. The research examines six key elements of housing design: interior space, space utilization, unit facilities, safety and security, design elements, and building components. A structured questionnaire was distributed to 345 households across three high-density, low-cost housing schemes, each consisting of over 200 units. The findings reveal a significant positive correlation between housing quality factors and resident satisfaction. Specifically, elements such as interior spaces, safety measures, and well-planned design were identified as key contributors to improved resident satisfaction. These results underscore the need for policymakers and developers to prioritize quality design and tailored interventions in addressing the challenges faced by low-cost housing communities in urban areas.

1.0 INTRODUCTION

Residents of high-rise, low-cost housing in Penang face multiple challenges that significantly impact their overall satisfaction with housing quality. One of the primary issues is overcrowding and poor design quality, as many housing units have limited space and inefficient layouts that fail to accommodate the diverse needs of occupants (Altaş & Özsoy, 1998; Erasmus, 2010; Chiarantoni, C. 2025). Additionally, inadequate facilities and amenities contribute to dissatisfaction, as residents struggle with insufficient public spaces, poorly maintained recreational areas, and a lack of essential infrastructure such as proper sanitation and waste management systems (Kalonda, J. K., & Govender, K. 2021; Smith, 2011; Oh, 2000). Safety and security concerns further exacerbate the problem, with high crime rates and poorly maintained security measures, including broken lighting and inadequate surveillance, creating an unsafe living environment (Abunike, U. E. I. R. C., 2025; Sheppard, C. L., et al., 2022; Gielen & Shields, 2012; Karim, 2012; Yaran, 2008).

Moreover, the lack of effective maintenance and building management worsens these challenges, leading to structural deterioration and mismanagement of maintenance responsibilities (Ismail et al., 2015; Gan et al., 2016). Socio-economic constraints further intensify housing issues, as lower-income residents often struggle with financial limitations, limited social interaction, and a lack of community engagement, resulting in widespread dissatisfaction with their living conditions (Mohit & Azim, 2012; Pawson & Sosenko, 2012). Addressing the quality of life in low-income housing is particularly crucial in developing countries, where poor living conditions and lack of safety measures are persistent concerns (Kowaltowski et al., 2006). Studies indicate that while some aspects of low-cost housing, such as affordability, may be satisfactory, neighborhood safety and access to communal facilities remain key areas of concern (Adriaanse, 2007; Berkoz, Turk & Kellekci, 2008; Ismail et al., 2015; Mohamed et al., 2014; Rashid, Ngah & Eluwa, 2013; Salleh, 2012; Temelova & Slezakova, 2014; Turkuoglu, 1997a). Furthermore, demographic factors also influence housing satisfaction. Research highlights that elderly residents often find housing design inadequate for their needs, which can lead to stress and reduced well-being (Demirkiran & Okyay, 2013).

Given these persistent challenges, this study aims to examine the correlation between housing quality and resident satisfaction in high-rise, low-cost housing in Penang by analyzing key design elements such as interior space, space utilization, unit facilities, safety and security, design features, and building components. By investigating how different elements of housing quality influence resident satisfaction, this study seeks to provide empirical evidence that can guide policymakers, developers, and housing authorities in improving the quality of affordable housing. The findings will help inform strategies to enhance living conditions, promote community well-being, and address the critical issues faced by residents in urban low-cost housing developments.

2.0 LITERATURE REVIEW

Housing quality plays a crucial role in shaping the well-being and satisfaction of residents, encompassing key factors such as housing design, safety, available facilities, and the surrounding environment (Zhan et al., 2022; Mahazril, Ã et al., 2022). Recent studies emphasize that housing quality is a multidimensional concept shaped not only by physical attributes but also by social and environmental factors, with residential satisfaction in low-cost housing influenced by elements such as location, public amenities, surrounding environment, cultural compatibility, safety, sense of community, and neighborhood conditions (Chik, Z et al., 2021). According to Goodman (1978), the determination of housing quality is influenced by variables such as income, family size, education, and ethnicity—insights that still underpin contemporary frameworks, although more recent literature incorporates psychosocial and cultural dimensions.

Djebarni and Al-Abed (2000) identified residential units, neighborhoods, and community services as key components of the housing environment model. Recent Malaysian research expands on this by highlighting residents' perceptions of housing adequacy and their interactions with surrounding infrastructure (Roslan, S. N. M. et al., 2025). Housing quality is now commonly assessed based on interior layout, exterior aesthetics, safety measures, and the integration of green and communal spaces (Obeidat, A. M., & Obeidat, A. M., 2024). Studies have highlighted the close relationship between housing environments and housing quality, as both the interior and exterior aspects of housing influence residents' living experiences (Chowdhury, S et al., 2021; Uşma, G, 2025). Erasmus (2010) emphasized structural quality and accessibility, while newer studies incorporate smart design principles and environmental performance as crucial to resident well-being.

Findings from various statistical analyses confirm that housing quality is significantly correlated with factors such as design and construction standards, the provision and quality of facilities, and residents' specific needs (Mbazor, D et al., 2024). In Malaysia, housing quality has been increasingly recognized as a key factor contributing to overall resident satisfaction, especially in high-density developments (Salleh et al., 2020). Muhammad et al. (2015) defined good housing quality as the ability of housing units to provide basic facilities for their occupants. Housing quality in Malaysia, particularly in high-rise, low-cost developments, is strongly influenced by environmental factors, including air ventilation, natural lighting, and the overall performance of indoor and outdoor environments.

This study seeks to fill this gap by examining the correlation between housing quality and resident satisfaction, with a focus on key design elements such as interior space, space utilization, unit facilities, safety and security, design features, and building components. Through a structured quantitative analysis, this study aims to provide measurable insights into the extent to which these factors influence resident satisfaction. Respondents' positive evaluations of apartment features such as design, construction quality, and affordability are strongly associated with housing satisfaction, while factors like location and the quality of the surrounding environment also play a significant role in influencing overall satisfaction.

To strengthen the study's theoretical foundation, several established theories on housing quality and satisfaction are integrated into the research framework. Maslow's Hierarchy of Needs (1943) continues to be relevant, with recent applications linking shelter and psychological security to resident contentment. The Housing Adjustment Theory (Morris & Winter, 1975) remains significant, especially as residents in constrained housing conditions adapt their expectations. Newman's Defensible Space Theory (1972) is supported by recent work showing how spatial design and visibility contribute to perceived safety (Lee et al., 2021). Additionally, Biophilic Design Theory (Kellert, 2005) and Sustainable Housing Design Theory (Vale & Vale, 1991) are increasingly cited in the context of urban resilience and sustainable living, with researchers highlighting their application in affordable housing development.

2.1 Housing Design

This study focuses on two theories related to housing satisfaction and the quality of housing itself: Maslow's Housing Needs Theory (1943), and Rossi (1955) and Morris and Winter's Housing Deficit Theory (1978), which pertain to housing satisfaction. These two theories are integrated to achieve a better quality of life in housing design. Rossi (1955) is among the researchers who developed the residential mobility model.

Theoretical perspectives on housing design emphasize its profound impact on the quality of housing and its ability to fulfill the diverse needs of occupants. Maslow's Hierarchy of Needs (1943) underscores the importance of housing in meeting both basic physiological requirements, such as shelter and safety, and higher-level needs, including social connection and self-actualization. Complementing this, the Housing Adjustment Theory by Morris and Winter (1975) highlights the dynamic nature of housing, suggesting that designs must accommodate evolving household needs through flexibility and adaptability. Newman's Defensible Space Theory (1972) further explores how thoughtful design features, such as clear boundaries and communal areas, can foster safety and social cohesion within residential environments. Additionally, Biophilic Design Theory (Kellert, 2005) advocates for incorporating natural elements like greenery, natural light, and ventilation into housing to enhance physical and mental well-being. Lastly, Sustainable Housing Design Theory Clapham, D. (2009) emphasizes environmentally conscious practices, integrating energy efficiency and sustainable materials to address long-term environmental and economic challenges. Together, these theories provide a comprehensive framework for understanding how well-designed housing can elevate both the quality of life and the sustainability of residential spaces.

Housing design serves as a fundamental determinant of housing quality, as it profoundly impacts the functionality, comfort, and overall livability of a dwelling. Comprehensive design strategies prioritize optimal space utilization, structural integrity, environmental sustainability, and the integration of safety features. Moreover, thoughtful housing design ensures accessibility and adaptability, addressing the diverse needs of occupants while fostering a sense of well-being and satisfaction, thereby elevating the overall living experience. According to Ozer and Jacoby (2022), the pandemic has influenced various aspects of design-related housing, such as environmental comfort, the ability to make changes to a home, notions of privacy and security, and space limitations. It highlights how shifts in domestic usage and future housing preferences could have a lasting impact on dwelling design.

2.2 Facilities

The provision of facilities is a critical determinant of housing quality, as it significantly impacts functionality, convenience, and residents' overall satisfaction. Fundamental amenities, including access to clean water, reliable electricity, proper sanitation, and efficient waste management systems, form the essential infrastructure for livable housing. In discussing urban housing issues and needs in Malaysia, Mahdzir, M et al. (2022) found that respondents were satisfied with the religious and socio-cultural amenities in residential areas, and most importantly, they did not consider ethnicity an issue when making decisions about purchasing a home. However, the selection of locations for low-cost housing in Malaysia is determined by the Penang State Housing Department.

The study by Temelová and Slezáková (2014) identified that adult satisfaction with garden housing was relatively low after relocating from other neighborhoods, particularly when their emotional and social connections to previous locations were severed. This was compounded by their unfamiliarity with modern and new areas and the need to travel long distances to access public amenities. Smith (2011) provided several insights into the provision of amenities within walking distances, such as public open spaces and various educational, commercial, and recreational facilities. The availability of basic amenities in housing areas contributes to improved quality of life in the future.

Additionally, Oh (2000) revealed in his study that residents were dissatisfied with the size of kitchens, piped water services, and public amenities, such as those in recreational areas, playgrounds, and public transportation services in residential areas. Previous research on public housing in Malaysia has focused on factors influencing residential satisfaction, including physical housing defects, poorly maintained public amenities, and inadequate social and physical environments (Hashim et al., 2015). Both spatial and non-spatial factors play an important role in modeling accessibility, with proximity to screening and treatment facilities being a key determinant influencing older adults' decisions to seek health services.

2.3 Safety

Safety is a fundamental component of housing quality, as it directly affects the well-being, comfort, and security of residents. A safe housing environment encompasses structural integrity, secure access points, fire safety measures, and protection against natural hazards. Additionally, features like adequate lighting, proper ventilation, and neighborhood security contribute to creating a safe and livable space. Prioritizing safety in housing design and management not only safeguards residents but also fosters a sense of stability and trust within the community, ultimately enhancing the overall quality of housing. Security and safety factors, which are essential due to the need for neighborhood safety and crime prevention, have been studied in low-cost housing and public housing (Gielen & Shields, 2012; Husin & Nawawi, 2014; Karim, 2012; Zainal, Kaur, Ahmad & Mohd, 2015).

Ha and Weber (1994) identified seven critical dimensions of housing quality that encompass various aspects essential for evaluating residential environments. These dimensions include environmental safety, planning and landscaping, housing policy, the socio-cultural environment, public services, housing economics, and the physical quality of housing. Collectively, these dimensions provide a holistic framework that can guide housing policymakers in developing strategies to improve the quality of life for residents. According to Steg and Gifford (2005), safety and social security are personal issues, while Yaran (2008), in his discussion, viewed these as major problems linked to poor-quality design both inside and outside housing blocks. Design or architectural issues are closely associated with social problems, such as safety concerns within and around housing blocks.

2.4 Environment Neighborhoods

The quality of housing is significantly influenced by the characteristics of the surrounding neighborhood, as it shapes residents' daily experiences and overall satisfaction. Key factors such as accessibility to amenities, safety, social interactions, and environmental aesthetics contribute to creating a livable and cohesive community within the housing environment. Similarly, Lee, You, and Huang (2013) highlighted comparable elements of housing quality, emphasizing the importance of the indoor environment, safety, environmental

quality, facilities, and sports amenities. These aspects not only contribute to the functional and aesthetic appeal of housing but also provide opportunities for leisure and recreation, further enhancing residential satisfaction.

Moreover, the inclusion of neighborhood environmental characteristics, such as accessibility to amenities and communal spaces, underscores the interconnectedness between housing quality and the broader living environment. These comprehensive frameworks underscore the multifaceted nature of housing quality, offering valuable insights for urban planners and policymakers aiming to design housing developments that promote well-being and satisfaction among residents. Another study about sustainable housing aims to improve and refine indicators to achieve balance and equity in sustainable housing, ensuring a good quality of urban life where residents feel safe in their neighborhoods (Qusen Zumaya & Baqir Motlak, 2021).
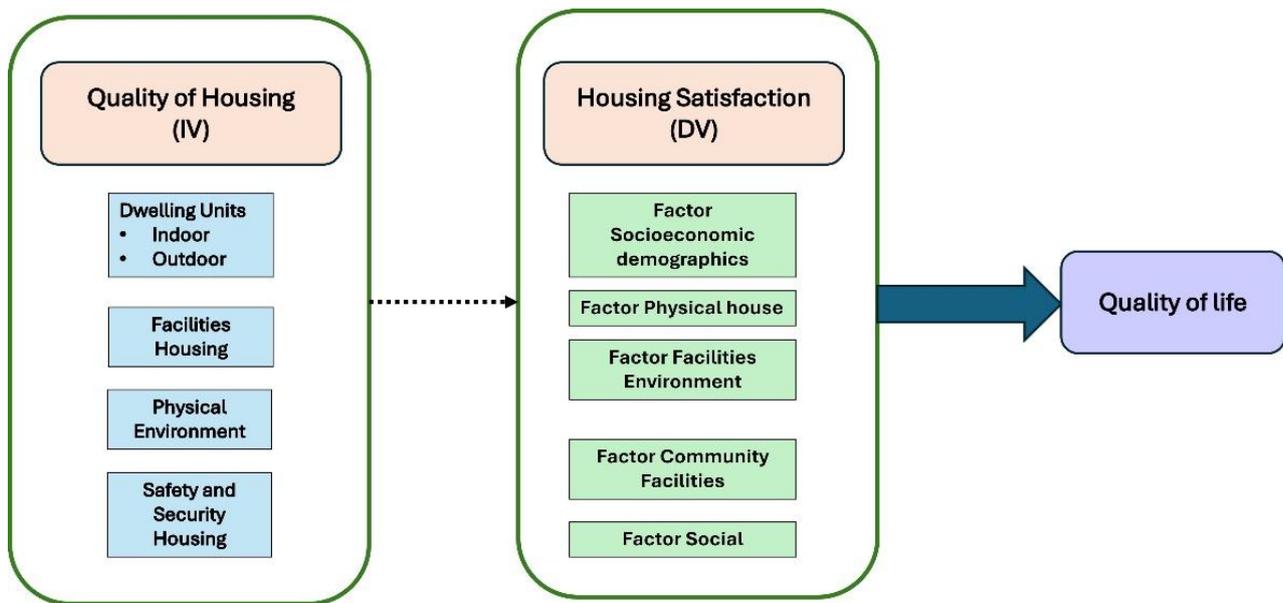
2.5 Housing Satisfaction

Satisfaction is commonly defined as the gap between expectations and performance, with a clear distinction between quality and satisfaction. Parasuraman, Berry, and Zeithaml (1991) emphasized that satisfaction is a decision made after recognizing that quality may differ. Variations in quality could reflect differences in acceptance levels depending on an individual's context or location.

The social environment plays a crucial role in assessing housing satisfaction, which is aimed at improving the quality of life within public and low-cost housing communities (Mohit & Azim, 2012; Mohit, Mansor, et al., 2010; Shearer, 2016). Evaluations of residential satisfaction are largely influenced by the neighborhood environment and the availability of facilities that contribute to the well-being of residents (Bonnes, Bonaiuto, & Ercolani, 1991; Cook, 1988; Eziyi O. Ibem, 2012). Providing adequate physical amenities can facilitate positive community interactions and social engagement among residents (Lawanson & Onifade, 2013). Moreover, the physical characteristics of housing, such as its condition, type, duration of residence, surrounding environment, and available amenities, play a significant role in determining residents' satisfaction (Zainal et al., 2015).

Further, the housing environment directly influences satisfaction with housing quality, particularly in relation to the physical aspects of the dwelling (Šiljeg, Marić, & Cavrić, 2018). The design and layout of residential areas, including communal spaces, ventilation, lighting, and window orientation, contribute to overall satisfaction (Mohit & Azim, 2012). The physical design elements, both within and outside the home, are key factors in shaping residents' satisfaction. Lee and Parrot (2004) identified eight critical elements affecting housing satisfaction for residents in U.S. apartments: the size of the living room, kitchen, number of bathrooms, overall housing size, kitchen location, pre-installed lighting, air conditioning, and maintenance services. A study conducted in Abu Dhabi revealed that while the majority of residents expressed overall satisfaction, the level of satisfaction was notably higher with the functionality of buildings and public facilities compared to the social environment within residential districts (Ibrahim, 2020).

The findings regarding rural and urban communities were mixed, highlighting the need to consider heterogeneity across all sociodemographic groups. It is recommended that public policy efforts aimed at improving life satisfaction (LS) among young people take these variations into account (Marquez & Long, 2021). The conceptual framework for this study illustrates the relationship between housing quality (independent variable) and housing satisfaction (dependent variable) and how they contribute to quality of life (refer to Figure 1). The framework identifies key components of housing quality, including dwelling units (indoor and outdoor conditions), housing facilities, physical environment, and safety/security. These factors influence housing satisfaction, which is further categorized into multiple dimensions such as socioeconomic demographics, physical housing conditions, facilities and environment, community facilities, and social aspects. The model suggests that improved housing quality enhances housing satisfaction, which in turn contributes to a higher overall quality of life. Additionally, this framework provides a structured approach to understanding the impact of housing conditions on residents' well-being and serves as a basis for further statistical analysis in the study.

Figure 1. The Conceptual Framework

The conceptual framework in this study illustrates the relationship between Quality of Housing (IV) and Housing Satisfaction (DV), and how both contribute to Quality of Life. The independent variable (IV), Quality of Housing, encompasses several key dimensions: dwelling units (indoor and outdoor), housing facilities, the physical environment, and safety and security aspects. These elements influence the dependent variable (DV), Housing Satisfaction, which is broken down into several contributing factors such as socioeconomic demographics, the physical condition of the house, environmental facilities, community facilities, and social aspects. Ultimately, the model proposes that improved housing quality positively impacts housing satisfaction, which in turn enhances the overall quality of life. This framework underlines the study's objective to assess how built environment attributes and resident perceptions collectively shape their living experiences and well-being.

3.0 METHODOLOGY

a) Research Design

This study employs a quantitative research approach to analyze the correlation between housing quality and resident satisfaction in high-rise low-cost housing in Penang. A cross-sectional survey design was adopted, enabling data collection at a single point in time to capture residents' perceptions effectively. This method ensures an efficient and structured evaluation of relationships between housing quality variables and satisfaction levels.

b) Study Area and Population

This study involved two separate authorities responsible for the data collection of high-rise, low-cost housing in Penang. Majlis Bandaraya Pulau Pinang (MBPP) oversees the housing schemes on Penang Island, while Majlis Perbandaran Seberang Perai (MPSP) is responsible for those in Seberang Perai. The study was conducted in three high-rise, low-cost housing schemes across Penang: Central Seberang Perai District, North-East Penang Island District, and South-West Penang Island District. These locations were selected for their high population density and the presence of over 200 housing units in each scheme, ensuring a diverse representation of residents from various urban settings. This geographical diversity allowed for a comprehensive understanding of the factors influencing resident satisfaction across different districts.

c) Data Collection Methods

The questionnaire administered in this study comprised 30 items organized into three main sections: (1) demographic information, (2) assessment of housing quality, and (3) evaluation of housing satisfaction. Each item was measured using a five-point Likert scale ranging from 1 (very dissatisfied) to 5 (very satisfied). The housing quality section focused on specific design elements, including room layout, storage capacity,

ventilation, and safety features, and was developed based on previously validated instruments (Adriaanse, 2007; Olotuah, 2015; Ismail et al., 2015). The housing satisfaction section gauged residents' perceptions related to overall comfort, functional convenience, and perceived quality of life. The study was conducted in three high-rise, low-cost housing areas: Study Area 1 comprised the TAJ housing scheme located in Seberang Perai Utara (SPU); Study Area 2 was the HK housing scheme situated in the North-East District of Penang Island (DTL); and Study Area 3 included the IS housing scheme in the South-West District of Penang Island (SPT). The selection of households was based on the population size in each respective district to facilitate accurate sampling calculations. Across the SPU, SPT, and DTL districts, a total of 1,708 low-cost housing units were identified, with an overall population distribution of approximately 1,232,800 residents. Using the Krejcie and Morgan (1970) sampling table and referring to population data from 2008 to 2014, the minimum required sample size for this study was calculated to be 313 respondents. To ensure robust representation and balanced regional distribution, a stratified random sampling technique was adopted, resulting in the final selection of 345 respondents, with 115 participants drawn from each study area.

The data collection process followed a structured, step-by-step approach: a pilot study was first conducted with 30 respondents to refine the questionnaire, ensuring its clarity, reliability, and content validity. Following this, trained enumerators distributed and collected the questionnaires through in-person visits to selected households. Finally, the collected responses were reviewed for completeness and consistency during the data cleaning and preparation phase, ensuring the data was ready for statistical analysis.

d) Data Analysis Techniques

The data collected were analyzed using the Statistical Package for the Social Sciences (SPSS), applying several statistical techniques to assess various aspects of the study. Descriptive statistics were first used, including frequency distributions and mean calculations, to summarize the demographic characteristics of the respondents. To examine the data distribution, normality tests, such as the Shapiro-Wilk and Kolmogorov-Smirnov tests, were conducted. The results of these tests indicated a non-normal distribution, which prompted the use of Spearman's rank correlation for further analysis.

Next, correlation analysis was performed using Pearson's Correlation Coefficient to assess the relationship between housing quality and resident satisfaction. The interpretation of the correlation followed Cohen's (1988) guidelines, where values of $r = .10$ to $.29$ were considered low, $r = .30$ to $.49$ moderate, and $r = .50$ to 1.0 high. To identify the predictive power of various housing quality factors on resident satisfaction, multiple linear regression analysis was applied. The model equation was used, where Y represents housing satisfaction, X represents housing quality, and $beta\_1$ is the coefficient that measures the effect of X on Y. The results showed an R value of 0.554, indicating a moderate positive correlation, and an R^2 value of 0.306, meaning that 30.6% of the variance in satisfaction could be explained by housing quality factors. The F-statistics of 151.578 with a p-value of less than 0.001 confirmed a significant model fit. A correlation of zero (0) indicates no linear relationship between the variables (Gogtay & Thatte, 2017).

The justification for using these statistical methods lies in their ability to provide a thorough analysis of the data. Pearson's correlation analysis was chosen to measure the strength and direction of the linear relationship between continuous variables, while regression analysis was used to determine how multiple housing quality components predict satisfaction. This combination allows for a comprehensive understanding of the relationship between housing quality and satisfaction. Correlation statistics are particularly valuable in this context as they help identify which specific aspects of housing quality are most closely associated with resident satisfaction, without necessarily implying causation. This approach provides clear insight into how the variables move in relation to one another, whether positively or negatively. By focusing on the correlation between housing quality and satisfaction, the analysis seeks to uncover patterns that reflect residents' perceptions and lived experiences. The application of SPSS software ensured the accuracy and reliability of the data handling and interpretation throughout the analysis.

Table 1. Guidelines for Interpreting the Strength of Correlation Coefficients
(Source: Cohen, 1988)

Correlation (r)	Interpretation
r = .10 to r = .29 (or -.29)	Low
r = .30 to r = .49 (or -.49)	Moderate
r = .50 to r = 1.0 (or -1.0)	High
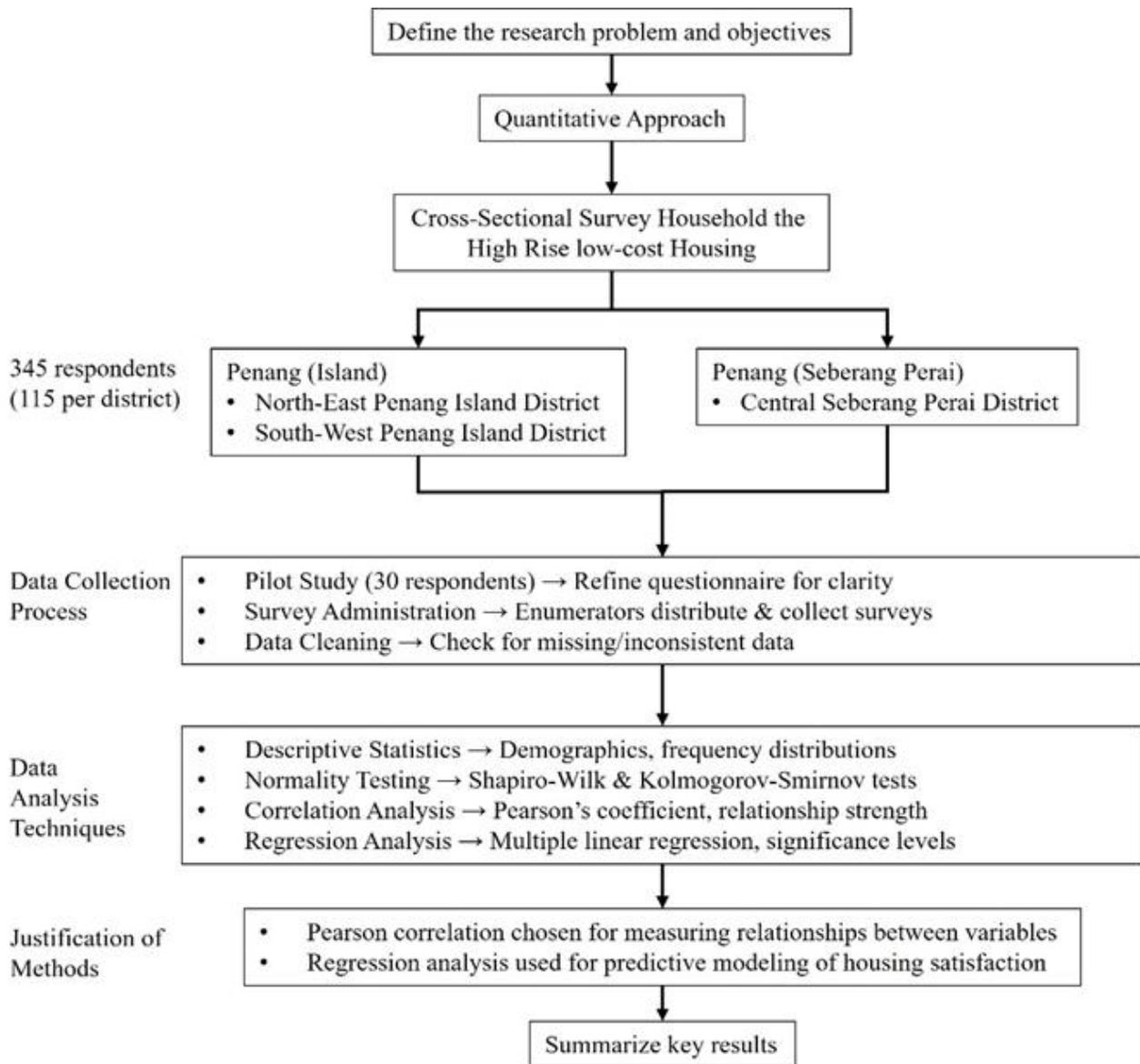
Figure 2. Flowchart Methodology.

4.0 RESULT AND DISCUSSION

4.1 Quality of Housing (QH)

As presented in Table 2, the results of the normality tests for the housing quality variable indicate a statistically significant deviation from normal distribution. Specifically, the Kolmogorov-Smirnov test yielded a p-value of 0.013, while the Shapiro-Wilk test returned a p-value of 0.000—both falling below the conventional significance threshold of 0.05. These findings suggest that the assumption of normality is not satisfied for this variable.

To corroborate the results of the normality tests, a histogram analysis was conducted, further illustrating a clear departure from the prototypical bell-shaped curve typically associated with normally distributed data. The distribution of the housing quality variable displayed noticeable skewness, heavy tails, and potential multimodality, consistent with the statistically significant outcomes of the Kolmogorov-Smirnov and Shapiro-Wilk tests (Figure 2). Given this non-normal distribution, the application of non-parametric statistical methods is deemed more appropriate for subsequent analyses involving the housing quality variable.

Accordingly, this study adopts non-parametric techniques, such as Spearman's rank correlation, which do not require the assumption of normality. This methodological choice is not simply a technical adjustment; it enhances the overall validity and reliability of the findings. Had parametric methods been used despite the violation of underlying assumptions, the analysis could have produced biased results and led to inaccurate

interpretations of the relationship between housing quality and resident satisfaction. In contrast, the use of non-parametric methods allows the analysis to more accurately reflect the true nature of the data and its distributional characteristics.

Beyond methodological considerations, the observed non-normality may also reflect real-world variability in how residents perceive housing quality. The skewed distribution could signify that perceptions are uneven across the population—some residents may report high satisfaction with certain housing features, while others may express dissatisfaction due to persistent structural or environmental shortcomings. This heterogeneity underscores the importance of tailored, context-sensitive interventions. For policymakers and housing authorities, these findings highlight the need to move beyond generic housing upgrades and toward more targeted strategies that address the diverse needs and lived experiences of residents in low-cost, high-rise housing developments.

Table 2. Quality of Housing (QH)

Quality of Housing	Kolmogorov-Smirnov	Shapiro-Wilk
Statistic	0.055	0.964
df	345	345
Sig. (p-value)	0.013	0.000

a. Lilliefors Significance Correction
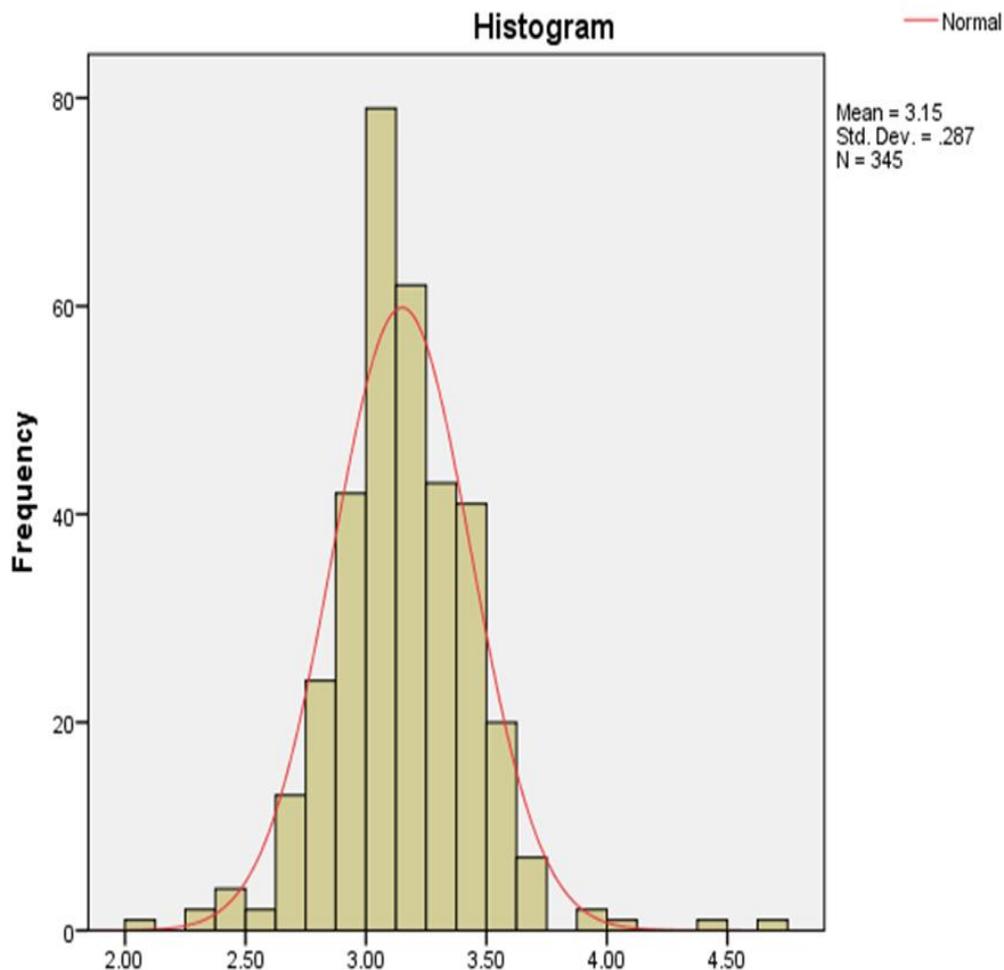
Figure 3. Histogram Quality of Housing (QH)

4.2 Satisfaction Housing (SH)

Similarly, the normality tests conducted for the Satisfaction of Housing (SH) variable indicate a statistically significant deviation from normality. The Kolmogorov-Smirnov test produced a p-value of 0.024, and the Shapiro-Wilk test yielded a p-value of 0.000—both of which are below the 0.05 threshold for statistical significance (Table 3). These results provide sufficient evidence to reject the null hypothesis of a normal distribution, suggesting that the SH variable does not conform to the assumption of normality.

This conclusion is further supported by the histogram presented in Figure 3, which reveals apparent skewness and irregularities in the data distribution, reinforcing the outcomes of the normality tests. Given this statistically significant non-normal pattern, non-parametric statistical methods are deemed more appropriate for analyzing the relationship between housing satisfaction and other variables.
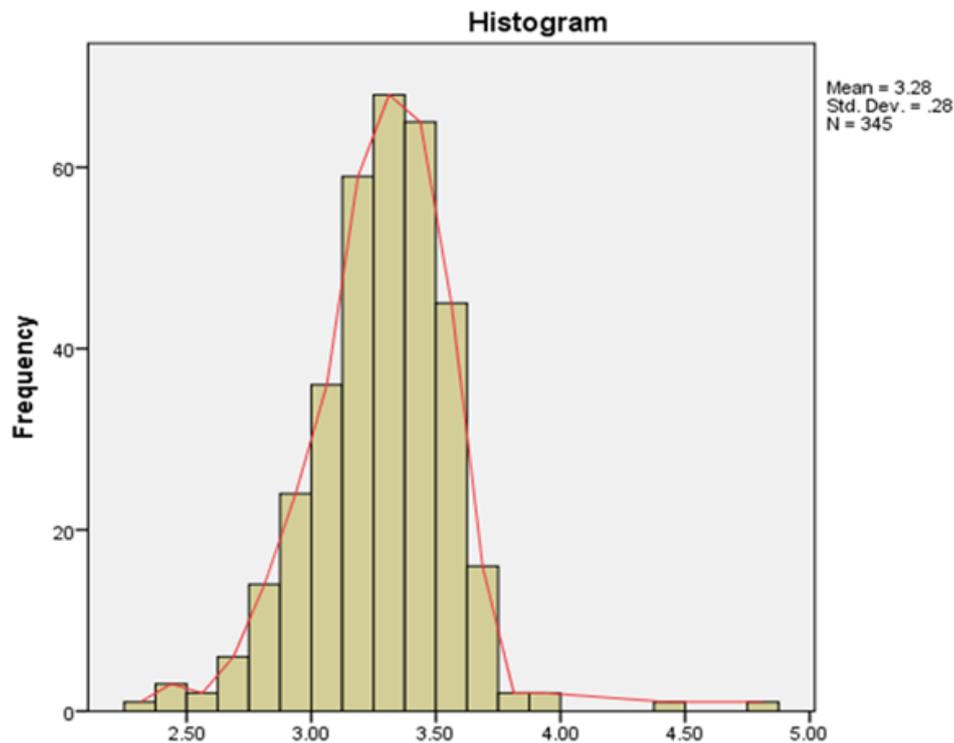
Table 3. Satisfaction Housing (SH)

Satisfaction Housing	Kolmogorov-Smirnov	Shapiro-Wilk
Statistic	.052	.960
df	345	345
Sig. (p-value)	.024	.000

a.   *Lilliefors Significance Correction*

The results from the Kolmogorov-Smirnov (p = 0.024) and Shapiro-Wilk (p = 0.000) tests indicate that the Satisfaction of Housing (SH) variable does not follow normal distribution (Table 3). This conclusion is further supported by the histogram (Figure 3), which illustrates a distribution that is slightly skewed and deviates from the ideal bell-shaped curve. Although the histogram appears somewhat symmetrical, the presence of skewness and potential outliers reinforces the statistical test results, confirming that the data violates the assumption of normality. Similarly, the Quality of Housing (QH) variable also fails both normality tests, suggesting that both variables do not meet the criteria for parametric analysis.

Considering these findings, the use of non-parametric statistical methods—such as Spearman's rank correlation—is deemed more appropriate for analyzing the relationship between QH and SH. The application of non-parametric techniques ensures the reliability and validity of results by accommodating the actual data distribution. This methodological decision aligns with established statistical guidance. Mishra et al. (2019) and Ghasemi and Zahediasl (2012) assert that p-values below the 0.05 threshold in normality tests warrant rejection of the null hypothesis of normality. Additionally, Orcan (2020) emphasizes that skewed or non-normally distributed data, especially those derived from Likert-scale instruments, require non-parametric treatment to avoid misleading conclusions. Similarly, Hair et al. (2019) warn against the misuse of parametric tests when the underlying assumptions are not satisfied. Furthermore, Chavan and Kulkarni (2017) highlight that non-parametric methods are particularly suitable for social science data, where ordinal variables and non-normal patterns are common.

Taken together, the statistically significant results of the normality tests, supported by visual evidence from histograms, justify the use of Spearman's rank correlation to examine the relationship between housing quality and satisfaction. If a statistically significant correlation is found, it suggests that improvements in housing quality, such as safety features, spatial layout, or amenities, can meaningfully enhance residents' satisfaction, thereby informing targeted policy and design interventions. Conversely, if the relationship is found to be weak or non-significant, it may indicate that other factors—such as affordability, social environment, or external stressors—play a more dominant role in shaping household satisfaction. In either case, the findings provide critical insights for urban planners and policymakers to more effectively address the lived experiences of households in low-cost, high-rise housing.

Figure 4. Histogram Satisfaction Housing (SH)

4.3 Correlation Analysis

The correlation analysis between housing quality and housing satisfaction yielded a Pearson correlation coefficient of 0.268 with a p-value of 0.000, indicating a positive but weak relationship between the two variables (see Table 4). This suggests that improvements in housing quality are generally associated with increased satisfaction among residents. However, the relatively modest strength of the correlation implies that housing quality alone is not the sole determinant of housing satisfaction. Rather, other contextual and social factors also play important roles. This is consistent with prior research, which emphasizes the multidimensional nature of housing satisfaction, encompassing physical, psychological, environmental, and social dimensions (Salleh, 2012; Amerigo & Aragones, 1997; Kumar et al., 2021).

The statistical significance of the relationship, marked by a p-value below 0.01, confirms that the association is unlikely to have occurred by chance, validating the role of housing quality in shaping satisfaction. However, the weak correlation suggests that factors such as affordability, accessibility, safety, social interaction, and neighborhood conditions may exert additional or even stronger influences on residents' overall housing experience. Kumar et al. (2021) argue that residents' satisfaction and happiness are not solely determined by dwelling unit characteristics but also by broader environmental features and community dynamics. Similarly, Olayiwola and Ajala (2022) found that socio-economic characteristics significantly influence housing quality and perceptions of satisfaction in urban Nigerian settings. These results are also in line with findings by Mohit et al. (2010) and Lu (1999), who highlight the critical role of surrounding amenities and socio-spatial conditions in shaping satisfaction outcomes.

Overall, the findings reinforce the need for a holistic approach to housing development and policy, where improving structural quality is complemented by attention to the broader social and environmental context. Urban planners and housing providers should focus on integrated solutions that address both the physical and social dimensions of housing. Future studies may benefit from employing multivariate regression or structural equation modeling to evaluate the relative and combined impact of diverse variables on housing satisfaction (Mohit & Azim, 2012; Elsinga & Hoekstra, 2005; Marans & Rodgers, 1975). These findings underscore the importance for Malaysian policymakers to adopt integrated housing strategies—such as those outlined in the National Housing Policy (Dasar Perumahan Negara, 2018–2025)—which emphasize not only structural quality but also social inclusion, accessibility, and environmental sustainability to holistically enhance housing satisfaction.

Table 4. Relationship between Quality of Housing and Housing Satisfaction

Variables	Quality of Housing	Satisfaction
Quality of Housing	1.000	0.268 ()
Satisfaction	0.268 (∗∗)	1.000
Significance (2-tailed)	-	0.000
N (Sample Size)	345	345

Note: ∗∗ Correlation is significant at the 0.01 level (2-tailed).

This table presents the Pearson correlation results, indicating a weak but statistically significant positive correlation (r The weak relationship observed between housing quality and housing satisfaction can be attributed to a constellation of interrelated factors that extend beyond the physical attributes of the dwelling. Firstly, housing satisfaction is inherently multidimensional, shaped not only by the quality of construction but also by broader considerations such as financial security, community engagement, access to public services, and individual lifestyle needs. For instance, a resident may occupy a well-built, high-quality apartment yet report low satisfaction due to factors such as social isolation or long commuting times. This underscores the importance of viewing satisfaction as a composite outcome, rather than a direct function of housing quality alone.

The subjective perceptions and personal expectations play a pivotal role. Individuals hold diverse preferences regarding what constitutes desirable housing—while some may prioritize aesthetic features or modern materials, others may place higher value on practical considerations such as proximity to schools, green spaces, or places of employment. These varying expectations result in heterogeneous satisfaction levels, even among occupants of similarly constructed units. Thirdly, external environmental factors such as neighborhood safety, infrastructure, availability of amenities, and exposure to environmental risks significantly influence residential satisfaction.

In low-cost high-rise developments, particularly in multicultural urban settings, factors such as race, religion, community activity, infrastructure access, unit size, and social cohesion play a pivotal role in shaping residents' perceptions of housing quality and overall satisfaction. These influences extend beyond the physical attributes of the built environment, reflecting deeper cultural identities, religious practices, and social relationships embedded within the housing context. Prior studies have emphasized that satisfaction is not only determined by design and materiality but also by the degree to which housing aligns with occupants' cultural and social needs (Yahaya et al., 2017; Zainal et al., 2012; Salleh, 2008; Awotona, 1990; Jacka, K., Cain, R., & Sanliturk, C. 2024).

While much of the existing literature has acknowledged the relevance of environmental and socio-economic variables in influencing housing satisfaction (Mohit et al., 2012; Musthafa et al., 2024), this study advances discourse through a quantitative regression analysis, isolating specific design attributes that significantly predict satisfaction outcomes. The regression model confirms that spatial layout flexibility and safety features emerge as statistically significant predictors of satisfaction among residents of high-rise, low-cost housing. This indicates that while socio-cultural and infrastructural considerations remain vital, certain physical aspects of housing—particularly those related to comfort, adaptability, and security—have a measurable impact on how residents evaluate their living conditions.

These findings provide context-sensitive insights for urban policymakers, planners, and developers operating in densely populated areas. A one-size-fits-all approach to low-cost housing is inadequate; instead, the results support the call for human-centered design strategies that integrate cultural, social, and safety considerations alongside traditional planning norms. Regression outcomes in this study underscore the importance of addressing both the tangible (e.g., space, safety, layout) and intangible (e.g., community integration, cultural alignment) dimensions of housing in order to enhance satisfaction in high-density, low-income settings. = 0.268, p < 0.01) between quality of housing and housing satisfaction.

4.4 Regression Analysis

The results of the regression analysis, as presented in Table 5: Model Summary, offer meaningful insights into the relationship between housing quality and housing satisfaction. The correlation coefficient (R = 0.554)

indicates a moderate positive association, suggesting that improvements in housing quality are generally associated with higher levels of satisfaction among residents. However, this relationship is not particularly strong, reflecting the multifaceted nature of residential satisfaction and implying that other influencing variables are at play. The coefficient of determination (R^2 = 0.306) reveals that housing quality accounts for approximately 30.6% of the variance in housing satisfaction, while the remaining 69.4% is likely attributable to other unmeasured factors such as affordability, neighborhood safety, environmental quality, and access to amenities and services (Mohit et al., 2010; Olayiwola & Ajala, 2022; Kumar et al., 2021).

The adjusted R^2 value of 0.304, which accounts for the number of predictors in the model, closely aligns with the R^2 value, indicating that the model is statistically sound and not overfitted. Additionally, the standard error of the estimate (0.23336) reflects a moderate level of prediction error, reinforcing that while housing quality plays a significant role, it does not entirely explain residents' satisfaction levels. This aligns with findings from previous studies that emphasize the importance of integrating social, cultural, and environmental dimensions into housing assessments to gain a more holistic understanding of residential satisfaction (Salleh, 2008; Musthafa et al., 2024; Emusa & Idakwoji, 2024).

Overall, the results affirm that housing quality is a critical—but not exclusive—determinant of satisfaction. To enhance the explanatory power of future models, researchers are encouraged to include a broader array of predictors such as income level, tenure security, household size, accessibility, and neighborhood cohesion. Such an approach would provide a more comprehensive framework for evaluating satisfaction in high-rise, low-cost housing, particularly within complex urban environments characterized by diverse socioeconomic conditions.

The simple linear regression model used in this study is defined as:

$Y=\beta 0+\beta 1X+\epsilon$

Where:
- **Y:** Satisfaction of housing (dependent variable).
- **X:** Quality of housing (independent variable).
- **β0:** The intercept, representing the expected value of Y when X=0.
- **β1:** The slope, indicating the expected change in Y for a one-unit increase in X.
- **ε:** The error term, accounting for variability in Y not explained by X.

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.554	0.306	0.304	0.23336

Notes: Predictors: (Constant), Quality of Housing
Dependent Variable: Satisfaction of Housing

The regression analysis underscores specific aspects of housing quality that, when improved, can significantly enhance resident satisfaction in high-rise, low-cost housing. Among these, interior space and layout emerge as crucial determinants, as they affect daily comfort and functional adaptability for diverse household compositions. Optimizing room sizes and implementing flexible design layouts tailored to multigenerational or extended families could significantly elevate satisfaction levels. Likewise, safety and security are prioritized by residents, particularly in densely populated vertical environments. Rather than relying solely on structural measures, fostering community-based safety initiatives—such as resident watch groups or shared responsibility for common spaces—can improve both perceptions of safety and collective well-being. These strategies are supported by research highlighting the need for participatory approaches and dynamic housing standards that respond to residents' socio-spatial needs, especially in resettlement contexts (Hanapi, Ridzwan, & Keane, 2023).

In addition to structural features, communal facilities and environmental amenities play a key role in shaping satisfaction. Well-maintained recreational areas, green spaces, and functional parking zones contribute to livability and community cohesion. Furthermore, elements such as cleanliness, landscaping, and visual aesthetics enhance the perceived quality of the housing environment. Integrating natural elements like trees

and gardens not only improves air quality and comfort but also promotes psychological well-being. Social and cultural inclusiveness, supported by shared events or community centers, strengthens interpersonal relationships and fosters a sense of belonging. Moreover, consistent affordability and reliable maintenance services are vital for sustaining satisfaction, as they reduce residents' financial stress and ensure long-term functionality of the built environment. These findings affirm the importance of designing housing that is not only structurally sound but also responsive to the broader social and environmental needs of urban communities (Musthafa et al., 2024; Kumar et al., 2021; Hanapi et al., 2023).

Despite the valuable insights provided by this study, it is not without limitations. First, the research employs a quantitative, cross-sectional design that captures perceptions at a single point in time and may overlook evolving satisfaction patterns. Future studies could adopt longitudinal approaches to examine how satisfaction changes over time with aging infrastructure, socio-economic mobility, or improved service delivery. Additionally, this study focused on three housing projects in Penang, which may not fully represent the diverse spectrum of low-cost housing in Malaysia.

5.0 CONCLUSION

This study confirms a statistically significant yet moderate relationship between housing quality and resident satisfaction (r = 0.268), supporting previous research that highlights the complex, multidimensional nature of residential satisfaction (Salleh, 2012; Musthafa et al., 2024). Key design features—such as safety, spatial planning, and the availability of amenities—were found to meaningfully shape residents' experiences, particularly in the context of high-rise, low-cost housing. These findings suggest that housing quality cannot be viewed in isolation; rather, it must be approached as part of an integrated framework that includes social, environmental, and policy dimensions. The results also reaffirm the need to maintain housing affordability without sacrificing essential quality, highlighting a persistent challenge in balancing financial accessibility with decent living conditions. In this regard, enhancing community facilities, recreational infrastructure, and basic services emerge as essential for improving both physical comfort and residents' sense of belonging.

Based on these insights, the study recommends a resident-centric approach to housing design and development. Housing solutions should be tailored to the specific needs and preferences of the community, particularly through participatory planning processes that involve end-users in decision-making. Such engagement not only ensures alignment with user expectations but also fosters a sense of ownership and long-term satisfaction. Community feedback mechanisms and flexible design standards can help housing providers respond more effectively to the realities of urban low-income populations. Policymakers and urban planners are encouraged to integrate these elements into broader housing strategies that prioritize safety, accessibility, and inclusive infrastructure, especially in vertically dense environments. This holistic approach addresses both the physical structure and the socio-cultural fabric of housing, offering a robust pathway toward sustainable urban living.

While the study offers valuable contributions, it is not without limitations. The research employs a cross-sectional, quantitative design, which may not capture the full depth of residents lived experiences. Future studies should incorporate qualitative methods—such as interviews or focus groups—to explore perceptions and behaviors in greater depth. Additionally, this study is geographically limited to three high-rise, low-cost housing schemes in Penang, potentially constraining the generalizability of findings. Crucially, the research does not assess environmental comfort factors such as thermal performance, air quality, and acoustic conditions, which are particularly relevant in tropical urban climates (Therán-Nieto et al., 2023; Arshard, Arminda, & Kadir, 2022). Including these dimensions in future research would enhance the comprehensiveness of housing quality assessments and inform more resident-centered interventions.

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