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Assessing Resident Satisfaction With Public Facilities and Building Quality in Green Semanggi Mangrove Housing Using the Customer Satisfaction Index

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ABSTRACT
The growth of suburban housing in Indonesia has increased demand for better living environments, yet resident satisfaction in environmentally sensitive areas such as coastal mangrove zones remains underexplored. This study assessed inhabitants' satisfaction with public facilities and building physical quality in Green Semanggi Mangrove Housing, Surabaya, using the Customer Satisfaction Index (CSI) method. Unlike generic urban CSI studies, this research incorporated specific variables (humidity, drainage performance, and material durability) relevant to coastal mangrove settings, providing preliminary insights that may be adapted for future coastal residential developments. A quantitative descriptive approach used an online questionnaire survey with a validated Likert scale, administered to 106 residents selected via simple random sampling from 600 occupied units. Nineteen attributes covering public facilities and building physical quality were analysed using Pearson correlation (validity), Cronbach's Alpha (reliability), and CSI calculation (MSS, MIS, WF, WS). The overall CSI was 73.479% ("satisfied"), while the CSI for building physical quality was 67.800% ("satisfied" but lower). The lowest scoring attributes were indoor sanitation (MSS=3.151), drainage effectiveness (MSS=3.255), and roofing quality (MSS=3.255). Although residents are generally satisfied, building physical performance falls short of mangrove area demands, with implications for developers, authorities, and future research in environmentally significant coastal areas.

Keywords: *Building Physical Quality; Coastal Mangrove Housing; Customer Satisfaction Index; Public Facilities; Resident Satisfaction.*

1. Introduction

Housing is an important component of sustainable development, and it is closely linked with community well-being, health, and comfort [1]. While housing provision is typically discussed in terms of simply how many units are built, with the ongoing urban development and better understanding of sustainability issues, there should be a focus on public facilities and condition aspects (of buildings) that enable sustainable dwelling. Q-Measurements of housing quality, based on gone reviews, have come into vogue as residents' satisfaction directly represents the actual functionality and performance of residential neighbourhoods [2]

Locally, in the international context of sustainable urban development following the World Cities Report UN-Habitat [3], housing quality and residential buildings are at the heart of challenges identified for soil structure requirements, which define properties such as building feasibility and represent the environmental infrastructure level requisite to support a resilient city globally. This suggests that determinations regarding housing quality ought to be based not just on global patterns, but also on local relevance in places such as cities undergoing spatial extension.

Vol. 7, No. 1, pp. 291-305, 2026
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Publish: 30-07-2026 |

Green Semanggi Mangrove Housing is an urban area in a suburban zone that develops into residential housing located in Rungkut District, Surabaya City. This is driven by the lack of buildable land available in urban centres, pushing communities to opt for lower price groupings, with suburban spaces regarded as a more affordable and worthwhile housing option. This condition is consistent with the urban sprawl phenomenon, where residential development expands toward suburban areas due to land scarcity in city centres [4]. Owing to its proximity to the coastal mangrove ecosystems, which may influence building performance, including humidity levels in buildings and the effectiveness of drainage, with heavy reliance on redundancy when designing for those areas, as well as material durability under harsher conditions due to frequent exposure or event occurrence associated with tropical climate events characteristic within such a zone. At the time this research was conducted, about 600 housing units were occupied, showing that quantitative assessment is needed to understand residents' satisfaction with those public facilities and the physical quality of buildings [4].

Concerning national technical standards, refer to the Indonesian National Standard (SNI 03-1733-2004) [5] concerning urban residential planning procedures for housing facilities consisting of infrastructure and utilities such as neighbourhood road drainage systems, clean water supply, electricity networks, waste management systems, telecommunication network, green open space and social-health facility & religious/ worship aid. These standards are essentially benchmarks for the feasibility and functionality of the residential areas. The ease of access to these elements, and thus their quality, is an essential constituent part supporting public welfare, health, and comfort; as well, they are strong markers for successful residential development. Accordingly, the evaluation of public facilities and physical building conditions is essential to overall housing quality assessments [6].

In the last five years, some studies have adopted Customer Satisfaction Index (CSI) methodology to evaluate residents' satisfaction through a structured quantitative approach. The results show that CSI can be used to develop the overall satisfaction index [17, 9]. The number of studies focused on residents' satisfaction in coastal or mangrove-characteristic housing areas needs to be a focus. This research gap highlights the vital role of this study.

Preliminary observations in Green Semanggi Mangrove Housing show complaints about interior sanitation systems, roof and ceiling quality for several units, as well as the environmental drainage system. These conditions may indicate a discrepancy between the priority level and residents' evaluation of housing quality. Thus, a quantitative analysis using the Customer Satisfaction Index (CSI) method is needed to objectively assess whether satisfaction levels with public facilities and physical conditions of buildings are met.

This study fills this gap by applying the CSI method to a coastal mangrove housing case and examining whether (and how) these public facilities, as well as the quality of physical building conditions, are related to satisfaction via the marine area. The research contributes to CSI by being (i) the first empirical evidence of CSI, with respect to coastal suburban Indonesian housing; (ii) introducing new theories and identifying which resident attributes are most affected by their environment in relation to satisfaction with sea/mangrove environments; and providing a contextually tailored framework for assessing customer satisfaction that can be easily applied within similar developments worldwide.

Research objectives: 1) To assess overall CSI for the public facilities within Green Semanggi Mangrove Housing; (2) Evaluate CSIs of physical building quality; and (3) Determine low-performing attributes, providing reasons from their correlation with coastal environmental conditions.

The novelty of this study is that it includes the coastal-mangrove environmental context in CSI-based housing satisfaction analysis, which has not been previously achieved and appears rarely in civil engineering/housing studies literature where contextual factors tend to be systematically neglected.

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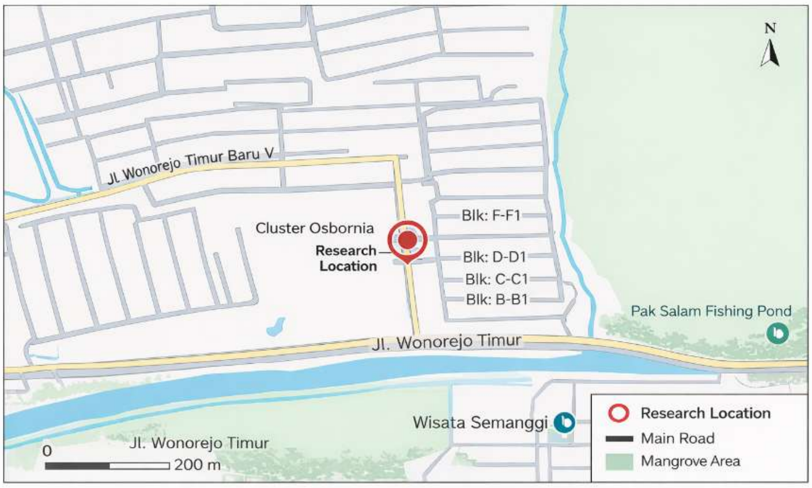

Figure 1. Research Location: Green Semanggi Mangrove Housing

Figure 1 presents the geographical location of the study area, Green Semanggi Mangrove Housing, situated in Rungkut District, Surabaya City, East Java. As shown in the map, the housing complex is located along the eastern coastal fringe of Surabaya, in proximity to the surrounding mangrove ecosystem. This spatial setting underlies the site-specific environmental conditions discussed earlier—namely elevated humidity, increased drainage load, and accelerated material degradation—which form the basis for the contextual variables examined in this study.

2. Materials and Methods

Green Semanggi Mangrove Housing in Surabaya was selected as the study area because of its location adjacent to a coastal-mangrove ecosystem. The study examined residents' satisfaction with public facilities and the physical quality of housing units using the Customer Satisfaction Index (CSI) approach. In addition to conventional housing quality indicators, environmental characteristics commonly found in coastal areas, such as high humidity, tidal influence, and groundwater conditions, were considered as contextual factors that may affect residents' perceptions. This section outlines the theoretical basis and methodological considerations that support the analysis carried out in the study.

2.1. Customer Satisfaction Index (CSI) in Housing Studies

The Customer Satisfaction Index (CSI) is a composite satisfaction index based on attribute-level scores weighted by their importance, where values are normalised to reflect only the maximum possible score. Originally designed for consumer services research, CSI was widely adapted in housing quality assessment as it assesses both the importance of attributes and satisfaction with actual performance at the same time 10. Armanto et al. CSI has been proven capable of differentiating satisfaction between residents who are satisfied and unsatisfied on all dimensions of building quality, facilities (Onet et al., 2010), and housing location [1]. Arinda [7] applied CSI to high-rise social housing (rusunawa) in Magelang and found that a CSI value above 70% indicates poor conditions and less dignified physical building attributes. In a study by Wibowo and Azizah [9], structural components, as well as communal facilities, were the main contributors to rusunawa dissatisfaction.

CSI's methodological strength is commonly expressed through Importance-Satisfaction Analysis (ISA), which allows you to focus your efforts on improving the attributes where, along with high importance, there exists a larger satisfaction-importance gap. Recent residential satisfaction studies have also demonstrated that satisfaction-based assessment methods remain effective for evaluating housing performance and identifying priority areas for improvement in residential environments [16]. This research continues where this methodology left off, but expands into a new environmental context.

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2.2. Housing Quality Standards and Indicators

The Indonesian National Standard SNI 03-1733-2004 (2004) governs the types of public facilities provided in urban residential areas, which should include neighbourhood roads, drainage systems, drinking water supply, electricity distribution network, waste management system, and telecommunication networks [5]. These components form the basis for residents to evaluate the adequacy of public facilities.

Indicators of physical building quality, including structural stability, material durability and longevity, ventilation, natural lighting, suitability of space, and amenities, are assessed through resident perception surveys because subjective evaluation includes both objective performance benefits and socio-cultural norms and environmental factors that shape residents' expectations. Recent research has further shown that residential comfort, including ventilation quality, natural lighting, indoor environmental conditions, and housing functionality, significantly influences residents' overall satisfaction with their housing environment [17].

2.3. Coastal-Mangrove Environmental Context and Housing Performance

Houses close to coastal mangrove ecosystems face specific environmental challenges that differ from those faced by houses in inland urban environments. Zhu et al. Environmental proximity is found to be a strong moderator of residential contentment, especially for infrastructure durability and indoor comfort-oriented attributes [4]. The environmental features of coastal regions include high humidity (often 80–95%), salt-laden air, accelerated corrosion attacks on metal fixtures, rapid deterioration of cement-based materials, a greater propensity for groundwater-induced dampness, and inundation from tidal flooding or surge events.

All of these conditions have direct impacts on multiple dimensions of housing quality: (i) tidal backflow and soil saturation force-out their effective drainage system; structural integrity is immediately threatened by UV radiation, thermal cycling, and moisture build-up affecting roof & ceiling durability [52]; high groundwater tables can negatively affect septic function affecting indoor sanitation systems [53]; building materials degrade faster than typical non-coastal areas due to increased in-wave impact caused from sea level rise. In short, while this provides a theoretical rationale, no previous CSI study has empirically examined these coastal parameters as they appear in resident satisfaction data.

2.4. Limitations of CSI and Methodological Considerations

Although CSI offers a strong summary measure, it has several known limitations that were taken into account in this design. First, CSI is seasonally sensitive to external conditions that may bias satisfaction reporting, including housing quality (e.g., temperature), mood of the respondent, and socioeconomic factors. Second, CSI is only measured at a particular time in the cross-section and does not allow for analysis of temporal dynamics (e.g., drainage satisfaction deteriorating post-rainy season). Similar limitations have also been identified in residential satisfaction studies, where satisfaction levels may change over time due to environmental conditions, housing maintenance, and neighbourhood development processes [18]. Third, the 10% margin of error used in sample determination of those to be sampled is pragmatically appropriate given resource limitations faced by many studies (i.e. Fourth, the case study design at a single site has limited generalizability to more similar coastal mangrove housing typologies. The primary emphasis of CSI is on ordinal Likert data, which facilitates binary coding as either True or False for errors, hence mitigating problematic parametric statistical analyses. These limitations pertain to the interpretation of this study's findings. The computation of the CSI, particularly for musical quality (Attributes 9–19), is executed in a systematic sequence as outlined below:

2.5. Previous Research Summary

Table 1 illustrates the gap addressed by the current study by summarising notable previous research on residential satisfaction employing the CSI.

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Table 1. Summary of Previous Research on Residential Satisfaction

No	Author (Year)	Location	Method	Key Findings	Difference with Present Study
[1]	Armanto et al. (2024)	Urban housing, Indonesia	CSI, survey	Building quality, facilities, and location determine satisfaction	No coastal/mangrove environmental context; no CSI quantification
[6]	Aritonang et al. (2019)	Medan Johor District	Descriptive survey	Facility availability affects satisfaction	No CSI calculation; no physical building quality analysis
[7]	Arinda (2021)	Rusunawa Tidar, Magelang	CSI	CSI <70% for physical and service attributes	High-rise social housing; no coastal environmental factor
[9]	Wibowo & Azizah (2024)	Rusunawa, Indonesia	CSI analysis	Structural components drive dissatisfaction	Social housing typology; no mangrove/coastal context
[10]	Arman et al. (2025)	Green Home concept housing	CSI	Green home attributes moderately satisfy residents	Green sustainability focus; no coastal proximity analysis
Present Study	Apriliani et al. (2025)	Green Semanggi Mangrove Housing, Surabaya	CSI (19 attributes)	CSI=73.479%; coastal factors explain low sanitation and drainage scores	First CSI study integrating coastal-mangrove environmental context

The studies reviewed above indicate that resident satisfaction is closely associated with the quality of public facilities and housing conditions. However, research examining these relationships within a coastal-mangrove residential setting remains limited. This gap provides the rationale for applying the Customer Satisfaction Index (CSI) in the present study. The procedures used for data collection, sampling, measurement, and analysis are described in the following section.

2.6. Research Design

This study systematically measures and examines resident satisfaction levels using a descriptive quantitative approach. The quantitative aspect utilises numerical analysis to generate objective, measurable satisfaction indicators, while the descriptive aspect classifies the study variables, equipment, and respondent characteristics [6].

2.7. Research Variables and Indicators

Table 2 presents an exhaustive compilation of the research components and indicators assessed in this study.

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Table 2. Research Variables and Indicators

No	Variable	Indicator	Reference
1	Public Facilities	Condition of neighbourhood roads	[1][5][6]
2		Effectiveness of drainage system	[1][5][6]
3		Availability of clean water	[5][6]
4		Stability of electricity supply	[5][6]
5		Waste management system	[5][6]
6		Quality of telecommunication networks	[5]
7		Environmental safety and comfort	[1][6]
8		Flood-free conditions	[4][5]
9	Physical Building Quality	Exterior appearance	[1][10][11]
10		Suitability of size and spatial layout	[1][11]
11		Ventilation system	[10][11]
12		Natural lighting	[10][11]
13		Ceiling height	[11]
14		Quality of building materials	[1][10]
15		Effectiveness of rainwater drainage	[4][5][10]
16		Indoor sanitation conditions	[5][10]
17		Roof and ceiling quality	[1][10][11]
18		Drainage system effectiveness (indoor)	[4][5]
19		Overall building durability	[1][10]

Table 2 presents the variables and indicators used in this study. Resident satisfaction was assessed through two main variables, namely public facilities and physical building quality, comprising a total of nineteen indicators. The public facilities variable consists of eight indicators related to the availability and condition of supporting infrastructure within the housing area. In comparison, the physical building quality variable consists of eleven indicators associated with the condition and performance of housing units.

The indicators were not developed independently but were adapted from previous studies and relevant housing standards. Public facility indicators were derived from the works of Armanto et al. [1], Aritonang et al. [6], and the provisions of SNI 03-1733-2004 [5]. Meanwhile, indicators of physical building quality were adopted from previous housing satisfaction and housing quality studies conducted by Armanto et al. [1], Arman et al. [10], and Hadi [11]. The use of these indicators ensures that the assessment is based on variables that have been widely applied in previous residential satisfaction research while remaining relevant to the characteristics of the study area.

Vol. 7, No. 1, pp. 291-305, 2026
Submit: 10-04-2026 |
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Publish: 30-07-2026 |

2.8. Population and Sampling

This study used a cross-sectional design using 600 living house units from Green Semanggi Mangrove Housing. The above methods were simple random sampling, in which each unit in the population has an equal probability of selection, minimising bias and providing maximum representativeness. You conduct random sampling — you just number all 600 units in order, and then use a table of random numbers to choose the subjects. The objective of the study team was to locate eligible households and obtain participation from 1 adult (head-of-household or invited proxy) as a participant. To ensure that the selected households had to move it around, if needed.

The minimum sample size was determined using the Slovin formula:

$$n = N / (1 + N \cdot e^2)$$

$$n = 600 / (1 + 600 \cdot 0.1^2) = 600 / 7 \approx 85.71 \approx 86 \text{ respondents}$$

where n = required sample size, N = population size (600), and e = margin of error (10%). The study included 86 people in the final sample (approximately a 23% increase compared to the minimum required respondents) for statistical robustness and external validity reasons. Due to the exploratory nature of this work and resource limitations, we selected a 10% margin. Still, for more targeted future research, a 5% margin would be appropriate since it will provide greater detail.

2.9. Questionnaire Development, Pilot Testing, and Validation

The data analysis was conducted on a multiple-dimensional questionnaire tool; (i) literature search for potential indicators, (ii) two civil engineering professors consulted and content validity testing conducted via pilot-fielding of 30 non-sample respondents to test for comprehensive evaluation and item clarity,(iii) then formal reliability stress test statistics followed by exploratory confirmatory in sociodemographic validation. Before conducting the full runs, the items were pilot tested individually, and 20% or fewer of respondents suggested that any aspect was unclear or had been misinterpreted.

Respondents' demographic data, including gender, age (in years), length of residency, and housing ownership status, were documented. These variables are incorporated to offer context for analysing satisfaction disparities among subgroups; however, a comprehensive subgroup analysis exceeds the study's scope.

2.10. Measurement Scale

Table 3 displays the Likert scale employed to assess importance and satisfaction.

Table 3. Likert Scale Classification

Score	Importance Category	Satisfaction Category	CSI Range (%)
5	Very Important	Very Satisfied	81% – 100%
4	Important	Satisfied	61% – 80%
3	Neutral	Neutral	41% – 60%
2	Unimportant	Dissatisfied	21% – 40%
1	Very Unimportant	Very Dissatisfied	0% – 20%

Table 3 presents the Likert scale used in this study to measure the importance and satisfaction levels of each attribute. Respondents were asked to rate each indicator on a scale from 1 to 5. For the importance assessment, a score of 1 indicates that an attribute is considered very unimportant, while a score of 5 indicates that it is considered very important. For the satisfaction assessment, a score of 1 represents very dissatisfied and a score of 5 represents very satisfied. The responses obtained from both assessments were then used to calculate the Customer Satisfaction Index (CSI), which was subsequently interpreted according to the satisfaction categories shown in Table 3.

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2.11. Data Analysis: Customer Satisfaction Index (CSI)

IBM SPSS Statistics 25 was used to process the data to assess validity and reliability. Microsoft Excel was used for CSI computations. The analytical process consists of four consecutive steps:

Step 1: Mean Satisfaction Score (MSS) and Mean Importance Score (MIS): MIS and MSS are computed as follows for each attribute i:

$$MIS_i = \Sigma Y_i / n \quad \ldots(1) \qquad MSS_i = \Sigma X_i / n \quad \ldots(2)$$

where n is the number of respondents (106), X is the total satisfaction score for attribute I, and Y is the total importance score for attribute I.

Step 2: Weight Factor (WF): Each attribute's relative importance weight is:

$$WF_i = MIS_i / \Sigma MIS_i \quad \ldots(3)$$

Step 3 – Weight Score (WS):

$$WS_i = WF_i \times MSS_i \quad \ldots(4)$$

Step 4 – Customer Satisfaction Index (CSI):

$$CSI = (\Sigma WS_i / HS) \times 100\% \quad \ldots(5)$$

where HS = maximum scale value = 5. The resulting CSI value is interpreted using the satisfaction categories in Table 3.

3. Results and Discussions

3.1. Respondent Demographic Profile

The study involved 106 respondents, representing 17.67% of the occupied housing units. Sex: 54% male — 46% female. The majority (62%) of respondents had lived in the same housing complex for between two and five years, so would be sufficiently embedded in this area of property ownership/end-management to fairly ascertain quality. It is 78% owner-occupier, and the remaining (22%) are tenants. Just their features are good evidence of a resident population living (for the long term) in housing quality assessment.

3.2. Validity and Reliability Testing

The questionnaire was subjected to validity and reliability testing to verify psychometric soundness before CSI analysis.

To ensure that the questionnaire was suitable for subsequent analysis, validity and reliability tests were conducted on all measurement items. The validity test examined whether each questionnaire item accurately measured the intended construct, while the reliability test evaluated the consistency of responses across the measurement scales. The results of these tests are presented in Table 4.

Table 4. Validity Test Results (r-table = 0.1909 at $\alpha = 0.05$, n = 106)

No	r-count (Satisfaction)	r-count (Importance)	r-table	Status	Attribute
1	0.480	0.729	0.1909	Valid	Neighbourhood road condition
2	0.528	0.542	0.1909	Valid	Environmental drainage
3	0.533	0.653	0.1909	Valid	Clean water availability
4	0.587	0.567	0.1909	Valid	Electricity stability
5	0.398	0.605	0.1909	Valid	Waste management
6	0.480	0.665	0.1909	Valid	Telecommunications network

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No	r-count (Satisfaction)	r-count (Importance)	r-table	Status	Attribute
7	0.501	0.464	0.1909	Valid	Safety and comfort
8	0.478	0.765	0.1909	Valid	Flood-free conditions
9	0.567	0.706	0.1909	Valid	Exterior appearance
10	0.474	0.765	0.1909	Valid	Spatial layout adequacy
11	0.573	0.710	0.1909	Valid	Ventilation system
12	0.699	0.770	0.1909	Valid	Natural lighting
13	0.721	0.737	0.1909	Valid	Ceiling height
14	0.583	0.643	0.1909	Valid	Building materials quality
15	0.476	0.621	0.1909	Valid	Rainwater drainage
16	0.645	0.755	0.1909	Valid	Indoor sanitation conditions
17	0.659	0.773	0.1909	Valid	Roof and ceiling quality
18	0.590	0.693	0.1909	Valid	Indoor drainage effectiveness
19	0.638	0.741	0.1909	Valid	Overall building durability

As presented in Table 4, all questionnaire items satisfied the validity criterion because the calculated correlation coefficients for both the satisfaction and importance dimensions exceeded the critical value (r-table = 0.1909). Furthermore, the Cronbach's Alpha values of 0.873 for the satisfaction scale and 0.933 for the importance scale indicate a high level of internal consistency. These findings confirm that the questionnaire is both valid and reliable, allowing it to be used confidently in the subsequent Customer Satisfaction Index (CSI) analysis.

3.3. MSS and MIS Analysis

The magnitude of total MIS (91.075) compared with total MSS (76.585) provides compelling evidence that residents tend to prefer housing attributes as more important than their present state of satisfaction suggests. Such importance-satisfaction gap is highest for attributes 16–19, which correspond to the physical building quality elements exposed to coastal-mangrove environmental challenges. Attributes 16 (indoor sanitation, MSS=3.255), 17 (roof and ceiling quality, MSS=3.151), 18 (indoor drainage effectiveness, MSS=3.349), and 19 (overall building durability, MSS=3.255)—are all below 3.5 and thus fall into the quartile of the lowest level of satisfaction.

Low MSS values of these attributes support the environmental hypothesis put forth in this study: a high-humidity coastal environment leads to fast degradation of roof membranes, mould and moisture entry into interior spaces, which violates health regulations, as well as drainage backflow during tidal occurrences. This produces a chronic dissatisfaction driven by the wider environment, and it bears no structural likeness to satisfaction deficits in non-coastal housing.

JICE Journal Innovation of Civil Engineering
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Submit: 10-04-2026 |
Accepted: 27-07-2026 |
Publish: 30-07-2026 |

The findings are consistent with previous studies that identified physical building conditions as an important determinant of residential satisfaction. Arinda [7] reported relatively low satisfaction levels for several physical housing attributes in rusunawa. At the same time, Wibowo and Azizah [9] found that structural and building-related components were among the primary sources of resident dissatisfaction. Similar observations have also been reported in recent studies, which indicate that housing comfort and building performance are closely associated with residential satisfaction, particularly for attributes related to sanitation, drainage systems, and building durability [19]. In the present study, the lowest satisfaction scores were also observed in attributes related to indoor sanitation, roof and ceiling quality, indoor drainage effectiveness, and overall building durability. However, unlike previous studies, these findings may also be influenced by the coastal-mangrove environment surrounding the housing area, where high humidity, groundwater intrusion, and drainage-related issues can accelerate building deterioration and reduce residential comfort.

To provide a clearer understanding of the differences between residents' expectations and their perceived satisfaction, the Mean Importance Score (MIS), Mean Satisfaction Score (MSS), and the gap between the two measures were calculated for each attribute. The results are presented in Table 5.

Table 5. MSS and MIS Results by Attribute

No	Attribute	MSS	MIS	Gap (MIS-MSS)
1	Neighbourhood road condition	4.189	4.774	0.585
2	Environmental drainage	4.142	4.849	0.707
3	Clean water availability	4.358	4.915	0.557
4	Electricity stability	4.660	4.896	0.236
5	Waste management	4.472	4.868	0.396
6	Telecommunications network	4.104	4.840	0.736
7	Safety and comfort	4.557	4.840	0.283
8	Flood-free conditions	4.358	4.840	0.482
9	Exterior appearance	4.198	4.736	0.538
10	Spatial layout adequacy	3.726	4.557	0.831 ⚠
11	Ventilation system	3.925	4.670	0.745 ⚠
12	Natural lighting	4.123	4.736	0.613
13	Ceiling height	4.198	4.802	0.604
14	Building materials quality	4.462	4.821	0.359
15	Rainwater drainage	4.104	4.783	0.679
16	Indoor sanitation conditions	3.255	4.774	1.519 ⚠⚠
17	Roof and ceiling quality	3.151	4.774	1.623 ⚠⚠
18	Indoor drainage effectiveness	3.349	4.821	1.472 ⚠⚠

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No	Attribute	MSS	MIS	Gap (MIS-MSS)
19	Overall building durability	3.255	4.783	1.528 ⚠⚠
	TOTAL	76.585	91.075	–

⚠ = Moderate gap (0.700–1.000); ⚠⚠ = High gap (>1.000)—priority attributes for improvement

As presented in Table 5, the Mean Importance Score (MIS) exceeded the Mean Satisfaction Score (MSS) for every assessed attribute, indicating that residents' expectations were consistently higher than their perceived level of satisfaction. Although most public facility attributes showed relatively small differences, several indicators related to building physical quality exhibited considerably larger gaps. The widest discrepancies were observed for indoor sanitation conditions, roof and ceiling quality, indoor drainage effectiveness, and overall building durability, suggesting that these aspects contribute most to residents' dissatisfaction. These findings indicate that improvements should be prioritised in building-related attributes to better align housing performance with residents' expectations.

3.4. Weight Factor and Weight Score Calculations

The Weight Factor values range from 4.56% to 4.92%, indicating that residents considered all assessed attributes to be important. Although the differences in weighting were relatively small, several attributes related to building quality produced lower Weight Scores due to their lower satisfaction ratings. The lowest Weight Scores were observed for indoor sanitation conditions, roof and ceiling quality, indoor drainage effectiveness, and overall building durability. These findings are in line with those reported by Wibowo and Azizah [9], who found that deficiencies in building-related components had a considerable influence on residents' overall evaluation of housing quality. This suggests that improvements in these attributes would likely contribute to a higher level of resident satisfaction.

Following the comparison between importance and satisfaction scores, the next stage of the CSI analysis involved calculating the Weight Factor (WF) and Weight Score (WS) for each attribute. The Weight Factor reflects the relative importance assigned by residents to each attribute, while the Weight Score combines importance and satisfaction to determine each attribute's contribution to the overall Customer Satisfaction Index. The calculation results are presented in Table 6.

Table 6. Weight Factor (WF) and Weight Score (WS) Results

No	Attribute	MIS	WF (%)	WS
1	Neighbourhood road condition	4.774	4.77%	19.995
2	Environmental drainage	4.849	4.85%	20.082
3	Clean water availability	4.915	4.92%	21.422
4	Electricity stability	4.896	4.90%	22.818
5	Waste management	4.868	4.87%	21.768
6	Telecommunications network	4.840	4.84%	19.861
7	Safety and comfort	4.840	4.84%	22.052
8	Flood-free conditions	4.840	4.84%	21.093
9	Exterior appearance	4.736	4.74%	19.882

Vol. 7, No. 1, pp. 291-305, 2026
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Accepted: 27-07-2026 |
Publish: 30-07-2026 |

No	Attribute	MIS	WF (%)	WS
10	Spatial layout adequacy	4.557	4.56%	16.980
11	Ventilation system	4.670	4.67%	18.327
12	Natural lighting	4.736	4.74%	19.524
13	Ceiling height	4.802	4.80%	20.159
14	Building materials quality	4.821	4.82%	21.511
15	Rainwater drainage	4.783	4.78%	19.628
16	Indoor sanitation conditions	4.774	4.77%	15.537
17	Roof and ceiling quality	4.774	4.77%	15.041
18	Indoor drainage effectiveness	4.821	4.82%	16.145
19	Overall building durability	4.783	4.78%	15.567
	TOTAL	91.075	100.00%	367.394

As shown in Table 6, the Weight Factor values vary only slightly across all attributes, indicating that residents considered each aspect of the housing environment to be important. Nevertheless, differences in the Weight Scores reveal that several building-related attributes contributed less to the overall satisfaction because of their comparatively lower satisfaction ratings. In particular, indoor sanitation conditions, roof and ceiling quality, indoor drainage effectiveness, and overall building durability produced the lowest Weight Scores, suggesting that improvements in these areas would have the greatest potential to enhance overall resident satisfaction.

3.5. Customer Satisfaction Index (CSI) Calculation

The overall CSI is derived from the total Weight Score and the maximum scale.

$$CSI = (\Sigma WS / HS) \times 100\% = (367.394 / 5) \times 100\% = 73.479\%$$

The overall CSI rating of 73.479% is situated within the 61%–80% range, categorising it as "Satisfied" according to Table 3. This signifies that, together, the inhabitants of Green Semanggi Mangrove Housing convey contentment with both public amenities and the structural quality of the buildings.

The overall CSI value of 73.479% indicates that residents were generally satisfied with the housing conditions. This finding is comparable to the results reported by Arman et al. [10], who found that residents of Green Home housing expressed generally positive satisfaction with their residential environment. However, Arinda [7] reported CSI values below 70% for several physical housing attributes in public housing developments. Although the overall CSI obtained in this study falls within the satisfied category, the relatively low scores recorded for sanitation, drainage, roof quality, and building durability suggest that improvements are still required in several aspects of building performance.

Similar findings have been reported in other residential satisfaction studies, where residents generally expressed positive perceptions of their housing environment while still identifying several physical building attributes as areas requiring improvement [20]. The sequential CSI calculation for developing physical quality (Attributes 9–19) is as follows:

Vol. 7, No. 1, pp. 291-305, 2026
Submit: 10-04-2026 |
Accepted: 27-07-2026 |
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Table 7. Step-by-Step CSI Calculation for Building Physical Quality (Attributes 9–19)

No	Attribute	MSS	MIS	WF (%)	WS	
9	Exterior appearance	4.198	4.736	19.24%	0.808	
10	Spatial layout adequacy	3.726	4.557	18.52%	0.690	
11	Ventilation system	3.925	4.670	18.97%	0.745	
12	Natural lighting	4.123	4.736	19.24%	0.793	
13	Ceiling height	4.198	4.802	19.51%	0.820	
14	Building materials quality	4.462	4.821	19.59%	0.874	
15	Rainwater drainage	4.104	4.783	19.43%	0.797	
16	Indoor sanitation conditions	3.255	4.774	19.40%	0.632	
17	Roof and ceiling quality	3.151	4.774	19.40%	0.612	
18	Indoor drainage effectiveness	3.349	4.821	19.59%	0.656	
19	Overall building durability	3.255	4.783	19.43%	0.633	
	TOTAL		52.457		8.060	CSI = $(8.060/\Sigma WF\times5)\times100\%$ = 67.80%

Table 7 summarises the Customer Satisfaction Index (CSI) calculation for the physical building quality attributes (Attributes 9–19). The analysis yielded a CSI value of 67.80%, indicating that residents were generally satisfied with the physical condition of their housing units. Nevertheless, this score remained lower than the overall CSI, suggesting that building-related aspects contributed less positively to overall residential satisfaction. Lower weighted scores were observed for indoor sanitation conditions, roof and ceiling quality, indoor drainage effectiveness, and overall building durability, indicating that these attributes represent the main areas requiring improvement.

4. Conclusions

This research quantitatively calculated residents' satisfaction with public facilities and physical building quality in Green Semanggi Mangrove Housing, a housing area of mangroves along coasts located in Surabaya, using the Customer Satisfaction Index (CSI) method. Conclusions: Based on a validated Likert-scale questionnaire with 19 attributes administered to 106 respondents, the study concluded:

Initially, the psychometric adequacy of the instrument was confirmed since all 19 attributes had validity (r-count > 0.1909) and high reliability in both satisfaction (Cronbach's Alpha = 0.873) and importance (Cronbach's Alpha = 0.933).

Second, the overall CSI value of 73.479% falls within the "Satisfied" category (61%-80%), indicating that Green Semanggi Mangrove Housing could meet residents' expectations for public facilities and building quality quite well.

Third, the CSI, broken down by building physical quality, is 67.80%, which is lower than the overall CSI and indicates that building Physical components are a major area of relative dissatisfaction among residents compared to other factor categories such as paperwork or staff behaviour. The four lowest-performing attributes—roof and ceiling quality (MSS=3.151), indoor sanitation (MSS=3.255), overall building durability (MSS=3.255), and indoor drainage effectiveness (MSS=3.349)—all correspond to building systems disproportionately affected by the coastal-mangrove environment (humidity, groundwater, tidal drainage, and material corrosion).

Fourth, by providing a context-sensitive CSI framework that integrates coastal-mangrove environmental factors into housing satisfaction analyses, this study theorises a contribution largely absent in prior CSI studies, using Indonesia as an example. The practical contribution is a series of evidence-based guidelines provided to developers, housing managers, and local authorities that can be acted on in relation to moisture-resistant roofing systems, elevated sanitation facilities, tidal-resistant drainage infrastructure, and the use of marine-grade building materials.

Considering these findings, housing providers should prioritise improvements to the four lowest-performing attributes: roof and ceiling quality, indoor sanitation, indoor drainage effectiveness, and overall building durability. Local authorities and housing managers are encouraged to implement regular maintenance of drainage systems, roofs, and sanitation facilities, particularly before and after the rainy season, to maintain housing quality in coastal areas. Future research is recommended to employ longitudinal CSI designs, use a smaller margin of error (5%) to improve statistical precision, and conduct subgroup analyses based on residents' characteristics to provide a more comprehensive understanding of residential satisfaction.

The main limitations of this study include: the single-site case study design limiting generalizability; the 10% margin of error; the cross-sectional measurement precluding seasonal analysis; and the absence of subgroup-level satisfaction analysis. Future research should address these limitations through longitudinal, multi-site studies with a 5% margin of error, enabling broader generalizability of the coastal CSI framework.

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