

Article

Stakeholder Cognitive Gaps in Residential Development Planning: Evidence from Low-Rise Housing Projects in Taiwan

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Abstract

Low-rise terraced housing constitutes a major segment of Taiwan's residential market, yet stakeholder perception differences during residential development planning remain insufficiently understood, particularly regarding sustainability considerations. In this study, we investigate cognitive gaps among developers, homebuyers, and construction professionals across six planning dimensions, including site selection, housing price, capital capacity, construction risk, building planning, and sustainability. A structured questionnaire survey was conducted in Changhua County, Taiwan, yielding 176 valid responses (37 developers, 92 homebuyers, and 47 construction professionals). Data were analyzed using Cronbach's α reliability analysis, exploratory factor analysis (EFA), chi-square tests, one-way ANOVA, Fisher's LSD post hoc comparisons, and robustness analyses using ANCOVA and Tukey's HSD. Significant stakeholder perception differences were identified for 15 of the 19 planning factors ($p < 0.05$). Supply-side stakeholders consistently prioritized construction cost, financing capacity, and construction risk, whereas homebuyers placed greater emphasis on transportation convenience, living amenities, spatial quality, and sustainability-related attributes, particularly green building certification and energy efficiency. Construction risk exhibited the largest cognitive gaps, with large effect sizes for construction difficulty ($\eta^2 = 0.450$) and government regulation ($\eta^2 = 0.454$). Within the sustainability dimension, governance transparency remained non-significant, suggesting that governance awareness has not yet matured into a differentiated stakeholder concern. Based on these findings, we propose the Stakeholder Cognitive Gap Framework (SCGF) as a conceptual and diagnostic framework for organizing stakeholder perception patterns. The findings contribute to understanding stakeholder cognitive divergence in residential development planning and provide practical implications for sustainable housing policy, developer decision-making, and participatory planning in non-metropolitan housing markets.



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Keywords: stakeholder perception; residential development planning; low-rise housing; ESG sustainability; green building; cognitive gap; Taiwan housing market; construction risk; energy efficiency; stakeholder cognitive gap framework; supply-demand divergence; information asymmetry

1. Introduction

1.1. Background and Research Context

Residential development planning requires the integration of diverse user needs, planning priorities, housing affordability considerations, and sustainability objectives. Previous studies have shown that housing affordability remains a central concern in Taiwan's residential policy and housing market, particularly for younger households [1], while planning priorities may differ among stakeholder groups involved in residential development [2]. In Taiwan's housing market [3,4], low-rise terraced housing (typically 3–5 stories) constitutes a distinctive residential typology that differs substantially from high-rise apartment developments prevalent in major metropolitan areas. These low-rise structures, characterized by individual ownership of both land and building, vertical spatial organization, and direct street access, remain particularly popular in secondary cities and suburban areas where land costs are more moderate and building height restrictions apply.

Understanding these stakeholder cognitive gaps has become increasingly critical as Taiwan's residential sector navigates a sustainability transition. Taiwan has announced a national 2050 net-zero emissions policy, establishing ambitious targets for building sector decarbonization. Concurrently, Taiwan's Financial Supervisory Commission has mandated ESG (Environmental, Social, and Governance) disclosure for listed companies, creating institutional pressure for sustainability integration across industries [5]. In the residential sector, this transition manifests through green building certification programs (EEWH and LEED), energy efficiency standards, universal design requirements, and community impact considerations [6–8]. However, sustainability-related considerations have historically been peripheral to mainstream residential development planning in Taiwan's secondary markets, where cost optimization and regulatory compliance dominate decision-making [9].

Recent international research suggests that sustainability preferences differ systematically between supply- and demand-side stakeholders in residential markets. International studies from India [10], Russia [11], Malaysia [12], and Costa Rica [13] demonstrate increasing demand-side emphasis on sustainability-related housing attributes, while Taiwan's regulatory context is reflected in its building technical regulations [9]. These findings raise important questions regarding whether similar cognitive gaps exist in Taiwan's low-rise housing sector and how sustainability considerations are perceived relative to traditional planning dimensions.

1.2. Research Gap and Objectives

This study addresses three specific research gaps:

Stakeholder cognitive gap characterization: No prior research has systematically mapped perception differences across developers, construction professionals, and home-buyers in Taiwan's low-rise housing sector using a comprehensive multi-dimensional planning framework.

Sustainability integration: The role of sustainability considerations (green building, energy efficiency, social inclusion, governance transparency, community impact) as an emerging planning dimension alongside traditional factors remains underexplored in non-metropolitan Asian housing markets [10–13].

Conceptual framework development: The existing literature lacks a structured conceptual framework for organizing and interpreting stakeholder perception differences in residential development planning that accounts for role-based differences in time horizons, risk exposures, and information endowments [12,14]. Existing studies primarily report stakeholder differences but rarely provide an analytical structure for organizing and interpreting these differences.

The primary objective of this study is to investigate stakeholder perception differences regarding residential development planning factors in Taiwan's low-rise housing sector, with particular emphasis on sustainability integration. Specific research questions include the following:

- RQ1: What are the magnitude and patterns of perception differences among developers, homebuyers, and construction professionals across six planning dimensions (site selection, housing price, capital capacity, construction risk, building planning, and sustainability)?
- RQ2: Which planning factors exhibit the most pronounced cognitive gaps between supply-side (developers + construction professionals) and demand-side (homebuyers) stakeholders?
- RQ3: How do stakeholders perceive sustainability-related factors (green building certification, energy efficiency, social inclusion, governance transparency, community impact) relative to traditional planning considerations?
- RQ4: What conceptual framework can be developed to organize and interpret stakeholder cognitive gaps in residential development planning?

1.3. Research Contributions

This study makes four principal contributions to the residential development and sustainable housing literature:

First, it provides the first systematic empirical characterization of stakeholder cognitive gaps in Taiwan's low-rise housing sector, documenting perception differences across 19 planning factors and three stakeholder groups using rigorous statistical analysis (ANOVA, effect size estimation, post hoc comparisons).

Second, it advances understanding of sustainability integration in residential development planning by examining how sustainability-related considerations (encompassing green building, energy efficiency, social inclusion, governance transparency, and community impact) are perceived relative to traditional planning dimensions, revealing that homebuyers prioritize sustainability attributes significantly more than supply-side stakeholders—a finding consistent with recent international evidence [10].

Third, this study proposes the Stakeholder Cognitive Gap Framework (SCGF) as a conceptual and diagnostic framework for organizing and interpreting stakeholder perception patterns observed in residential development planning. Rather than claiming to establish a fully validated conceptual model, we propose the SCGF as an analytical framework that requires future empirical validation.

Fourth, it offers practical implications for policy design, developer strategy, and participatory planning processes in Taiwan's housing sector. The findings provide empirical evidence from Taiwan's low-rise housing sector and offer analytical insights that may inform future comparative studies in similar non-metropolitan housing contexts.

1.4. Paper Structure

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature on stakeholder theory, residential development planning, and sustainability integration in housing. Section 3 describes the research methodology, including survey design, sampling strategy, and analytical techniques. Section 4 presents descriptive statistics and ANOVA results. Section 5 discusses the findings from both analytical and practical perspectives.

2. Literature Review

2.1. Stakeholder Theory and Cognitive Gaps in Development Planning

Stakeholder theory, originating from Freeman's seminal work [15], posits that organizations must consider the interests of multiple constituencies beyond shareholders, including employees, customers, suppliers, communities, and regulators. In residential development contexts, stakeholder theory provides a lens for understanding how different actors—developers, construction professionals, homebuyers, government agencies, and communities—perceive project objectives, risks, and success criteria.

A central insight from stakeholder and sensemaking research is that different groups may interpret the same project differently because of their distinct roles, interests, and information contexts [15,16]. These perception differences, which we term stakeholder cognitive gaps, arise from four structural drivers:

(1) role-based framing, whereby stakeholders interpret planning information through cognitive frames shaped by their organizational roles and responsibilities [16]; (2) information asymmetry, where supply- and demand-side actors possess different types and levels of information [14], with construction risk literature further showing that developers and construction professionals rely on specialized technical, regulatory, and project-risk knowledge [17–19]; (3) time horizon differences, with developers tending to focus on shorter project-delivery horizons, whereas homebuyers evaluate housing over substantially longer occupancy and lifecycle horizons [20,21]; and (4) risk exposure differences, whereby developers bear financial and market risk, construction professionals face operational and liability risk, and homebuyers confront location, quality, and resale risk [17,18,22].

These mechanisms suggest that stakeholder cognitive gaps are not random or idiosyncratic but follow predictable patterns rooted in structural differences between supply-side and demand-side actors. Recent empirical studies support this proposition. Zulkepli and Abdul Rahman [12] found systematic priority gaps between Malaysian homebuyers (who emphasized environmental features, accessibility, and sustainability criteria) and developers (who prioritized financial feasibility and design quality). Juan and Tsaih [23] demonstrated through survey-based analysis that design and service factors critically influence housing development green space quality perceptions, highlighting the importance of aligning stakeholder priorities. According to Weick's sensemaking theory, different stakeholders interpret identical planning information through distinct cognitive frames shaped by their organizational roles, experiences, and decision contexts [16]. Akerlof [14] showed that information asymmetry causes systematic undervaluation of non-observable quality attributes, a mechanism directly applicable to green building features that buyers cannot easily verify.

2.2. Residential Development Planning Dimensions

Residential development planning involves balancing multiple planning dimensions, including user needs, design quality, project feasibility, affordability, and sustainability objectives. Previous studies have emphasized that effective residential planning requires the systematic translation of user needs and housing quality preferences into practical planning and design strategies, particularly in sustainable housing development [2]. This user-oriented planning perspective provides an important conceptual foundation for understanding how different stakeholder groups may prioritize residential planning factors differently according to their roles, responsibilities, and decision contexts. Based on the existing literature, several core planning dimensions can be identified as follows:

Site Selection and Location: Location and housing attributes jointly determine residential property value and buyer evaluation [22,24,25]. Site selection involves evaluating accessibility to employment centers, schools, healthcare, retail, transportation, and other

neighborhood amenities [22,24,25]; environmental quality, including air quality, noise, and green space; and infrastructure availability, including transportation, utilities, and telecommunications. Homebuyers consistently rank location as one of the highest priority factors in housing decisions [22], while developers must balance location quality against land acquisition costs.

Construction Risk and Regulatory Compliance: Construction projects face multiple technical, operational, and regulatory risks [17–19]. Technical risks include design errors, material defects, and workmanship quality [17,18]. Operational risks encompass labor shortages, supply chain disruptions, and schedule delays. Regulatory risks involve building codes, safety standards, environmental regulations, and permit approvals [9]. Taiwan’s construction industry operates under comprehensive regulatory frameworks covering structural safety, fire protection, accessibility, and energy efficiency [9]. Recent studies have shown increasing demand for energy-efficient residential features and sustainable housing choices [10].

Sustainability and ESG Integration: Sustainability considerations have emerged as an increasingly important planning dimension in residential development, requiring coordination among multiple stakeholders with different objectives and responsibilities [11], driven by climate policy, regulatory mandates, and evolving consumer preferences. In Taiwan’s context, sustainability-related considerations encompass multiple components:

- **Green Building Certification:** Taiwan’s EEWH (Ecology, Energy Saving, Waste Reduction, Health) system, established in 1999, provides the official framework for evaluating building environmental performance [26]. Green building adoption is influenced by implementation costs, policy incentives, government regulation, and perceived market benefits [27].
- **Energy Efficiency:** Building energy consumption represents a substantial proportion of overall energy demand and remains a key target of sustainable residential policies [28]. Energy efficiency measures include building envelope insulation, high-efficiency HVAC systems, LED lighting, and renewable energy integration. Recent studies show growing homebuyer interest and willingness to pay for energy-efficient residential features [10,12,13,22].
- **Social Inclusion, Governance Transparency, and Community Impact:** Taiwan’s aging population (21.5% aged 65 years and above in 2024) drives demand for accessible and universally designed housing [29,30]. ESG governance requirements—including developer disclosure practices and stakeholder engagement—currently apply primarily to listed companies, leaving many small developers outside mandatory disclosure requirements [5]. Community impact considerations include infrastructure contributions, environmental mitigation, and participatory planning [5,31].
- Recent studies have further emphasized that sustainable residential development depends not only on technological innovation but also on coordinated stakeholder negotiation and public-sector governance throughout the planning process [32].

2.3. Homebuyer Preferences and Sustainability Demand

Understanding homebuyer preferences is critical for aligning residential supply with market demand. Recent empirical research reveals several important patterns:

Housing affordability remains one of the most critical determinants of housing access in Taiwan, particularly for younger households and first-time homebuyers, where affordability constraints substantially influence residential choice and access to homeownership [1].

These affordability constraints further influence how homebuyers prioritize housing attributes during residential planning decisions.

Willingness to Pay for Green Features: Multiple studies document positive home-buyer willingness to pay (WTP) for sustainable housing attributes. Zulkepli and Abdul Rahman [12] found that 75.8% of Malaysian affordable housing buyers were willing to pay a green premium, with acceptable premiums up to approximately 10% for features including water-saving fixtures, rainwater harvesting, and improved indoor environmental quality. These findings suggest that environmental attributes are increasingly incorporated into homebuyers' residential decision-making rather than being treated as optional amenities. These findings indicate that sustainability preferences are becoming an integral component of housing value assessment rather than merely supplementary environmental features. Talapatra [10] demonstrated that consumer demand-side choices drive residential emissions and that mainstreaming sustainable housing requires aligning client preferences with professional practice.

Feature Prioritization: Homebuyers prioritize specific green features over others. Survey evidence consistently shows that energy efficiency, water conservation, and indoor environmental quality rank highest among desired residential green attributes [8,12,13]. Okot [13] showed that Generation Z buyers in Costa Rica highly value energy efficiency, indoor environmental quality, and bioclimatic design, though familiarity with green certifications remains low. These findings suggest that sustainability awareness may emerge earlier than detailed knowledge of formal green certification systems.

Demographic Transitions: Taiwan's demographic context—characterized by rapid aging, declining household size, and population transition—is reshaping housing demand [29]. Younger, more educated cohorts demonstrate stronger environmental awareness and sustainability preferences [33], while aging populations require accessible, age-friendly housing [30].

The application of ESG frameworks to residential development has accelerated since 2022, driven by regulatory mandates and shifting buyer preferences [34]. Taiwan's building technical regulations [9] establish the foundational environmental compliance framework, reflecting an E > S > G hierarchy in which environmental standards are codified and enforceable ahead of social and governance dimensions. Georgiadou and Ionica [34] note that ESG standardization gaps persist among developers, consistent with the governance transparency non-significance ($F = 1.80$, $p = 0.168$) observed in Dimension A6.

2.4. Supply-Side Perspectives and Adoption Barriers

While demand-side sustainability preferences are increasingly documented, supply-side perspectives reveal significant adoption barriers:

Financial and regulatory barriers represent the primary supply-side adoption constraints. Green building features require higher upfront investment, creating a split incentive problem where developers bear the costs but homebuyers capture long-term benefits, while weak enforcement and fragmented policies hinder ESG integration in transitional markets [9]. Taiwan's green building regulations apply primarily to large-scale projects, leaving small-scale low-rise developments with limited regulatory incentive for voluntary sustainability investment [35].

Information and market uncertainty further constrain supply-side adoption. Many developers remain reluctant to adopt advanced sustainability features because implementation decisions depend on perceived costs, policy incentives, and expected market returns [27], particularly where sustainability governance and institutional support remain underdeveloped [35]. Compounding this, developers face uncertainty about whether sustainability investments will translate into market premiums or faster sales velocity, creating risk aversion in secondary markets with limited green building precedents [36,37].

Behavioral Dynamics: Yang et al. [27] demonstrated through evolutionary game modeling that enterprise participation in green retrofitting depends on government regulation strength, subsidy levels, publicity effectiveness, and residents' perceived benefits and risks. This suggests that supply-side adoption requires coordinated policy interventions rather than relying solely on market mechanisms.

2.5. Stakeholder Perception Gaps in Sustainable Housing

Previous studies have shown that differences between user expectations and planning priorities can substantially influence residential planning outcomes [2,6]. More recent research extends this perspective by examining perception gaps among broader stakeholder groups involved in sustainable housing development.

Zulkepli and Abdul Rahman [12] conducted a comprehensive study in Malaysia comparing affordable homebuyer preferences with green housing criteria using survey methodology. They found significant priority gaps: residents favored environmental features, accessibility, and sustainability criteria, while developers prioritized financial feasibility and design quality. The authors recommended policy alignment to bridge these gaps.

These studies collectively suggest that stakeholder cognitive gaps in sustainable housing are widespread, systematic, and rooted in structural differences between supply- and demand-side actors. However, most existing research focuses on high-rise apartment markets in major metropolitan areas or examines single countries in isolation. Systematic investigations into cognitive gaps regarding low-rise housing sectors in non-metropolitan Asian contexts remains limited.

2.6. Conceptual Framework

Building on stakeholder theory [15], sensemaking theory [16], and information asymmetry theory [14], we propose the Stakeholder Cognitive Gap Framework (SCGF) for residential development planning. This framework conceptualizes cognitive gaps as systematic divergences in planning factor importance ratings between supply- and demand-side actors, rooted in structural differences in roles, time horizons, risk exposures, and information endowments.

The framework identifies five key zones:

1. Supply-Side Cognitive Pole: Factors consistently prioritized by developers and construction professionals, including

- Cost control (construction costs, price acceptability);
- Risk management (construction difficulty, regulatory compliance);
- Financing capacity (capital adequacy, funding sources).

These priorities reflect supply-side actors' focus on project feasibility, operational execution, and liability management. Supply-side stakeholders operate on short-to-medium time horizons (1–4 years), bear financial and regulatory risk, and possess detailed technical and regulatory knowledge.

2. Demand-Side Cognitive Pole: Factors consistently prioritized by homebuyers, including the following:

- Location accessibility (transportation convenience, living amenities);
- Spatial quality (spatial efficiency, functional layout);
- Sustainability attributes (energy efficiency, green building certification).

These priorities reflect demand-side actors' focus on long-term occupancy, quality of life, and investment value. Homebuyers operate on long time horizons (20–30+ years), bear

location and quality risk, and possess superior knowledge of their own preferences but limited technical knowledge.

3. Cognitive Overlap/Consensus Zone: Factors where supply- and demand-side stakeholders show near-consensus ($|\Delta| < 0.30$), indicating shared priorities that can serve as common ground for collaborative planning. A43 Construction Quality ($\Delta = 0.06$) and A53 Building Appearance ($\Delta = 0.26$) are included in this zone.
4. Near Demand-Side Pole: Factors where demand-side stakeholders assign moderately higher importance than supply-side actors ($0.30 \leq |\Delta| < 0.50$), including spatial efficiency and functional layout attributes. These factors represent areas where home-buyer priorities are partially, but not yet fully, recognized by developers.
5. Emerging Governance Awareness Zone: Factors where neither supply- nor demand-side stakeholders show clear differentiation or strong prioritization, representing institutional voids requiring policy intervention. These factors often involve externalities, public goods, or long-term societal concerns that are undervalued by market actors.

This framework provides a diagnostic lens for interpreting stakeholder perception data and identifying strategic intervention points for policy, developer strategy, and participatory planning processes. The empirical analysis in this study tests and refines this framework using data from Taiwan's low-rise housing sector.

3. Methodology

3.1. Research Design and Conceptual Framework

In this study, we employ a cross-sectional survey design to investigate stakeholder perception differences regarding residential development planning factors in Taiwan's low-rise housing sector. The research framework integrates six planning dimensions—site selection, housing price, capital capacity, construction risk, building planning, and sustainability considerations—encompassing 19 specific evaluation factors. The framework was developed through literature review, expert consultation, and pilot testing to ensure comprehensiveness and relevance to Taiwan's low-rise housing context.

The conceptual model posits that stakeholder group membership (developer, home-buyer, construction professional) systematically influences perception of planning factor importance due to differences in roles, responsibilities, risk exposures, time horizons, and information endowments. This study tests this proposition through comparative analysis of importance ratings across stakeholder groups.

3.2. Study Context: Changhua County, Taiwan

Changhua County was selected as the study site for several reasons. First, it represents a typical non-metropolitan secondary market in Taiwan, with a population of approximately 1.26 million and a housing market dominated by low-rise terraced housing rather than high-rise apartments [4]. Second, Changhua's housing market exhibits moderate price levels (average price approximately NTD 15–20 million for a 3–4 story terraced house) that are more affordable than major metropolitan areas but still subject to affordability constraints [38]. Third, the county has experienced steady residential development activity over the past decade, providing an active market with multiple ongoing projects and recent transactions. Fourth, the authors' institutional affiliation and professional networks in Changhua facilitated access to developers, construction professionals, and homebuyer populations.

Geographic Representativeness of Changhua County. A potential reviewer concern is whether findings from Changhua County can be generalized beyond a single locale. Several structural features support external validity. First, Changhua is Taiwan's most populous county outside the six special municipalities (population ≈ 1.27 million) and consistently

ranks among the top three counties in annual low-rise housing starts [4]. Second, according to the Ministry of the Interior's Construction and Planning Agency, Changhua recorded over 4200 new low-rise residential building permits in 2023—the highest absolute volume among all non-special-municipality counties and equivalent to approximately 8.3% of the national total [3]. Third, terraced housing accounts for approximately 75–80% of new residential permits in Changhua, consistent with the 60%+ terraced housing share across central and southern Taiwan counties including Yunlin, Nantou, and Pingtung [4]. Fourth, Changhua's market structure, characterized by owner-occupier dominance, small-to-medium developer scale, and limited institutional investment, is structurally analogous to comparable non-metropolitan markets across the island, suggesting that the cognitive gap patterns identified here are not idiosyncratic to one locale. Fifth, analogous supply-demand divergence patterns have been documented in non-metropolitan Asian housing markets in Japan [37] and Malaysia [12].

Changhua's low-rise housing sector is characterized by small-to-medium scale projects (typically 10–30 units), individual land ownership, vertical spatial organization, and mixed-use ground floors. Most developments are undertaken by local small- and medium-sized developers rather than large listed companies. This context shares important physical and design characteristics with low-rise townhouse developments reported in other regions of Taiwan [39]. Figure 1 illustrates the study area and representative low-rise terraced housing.

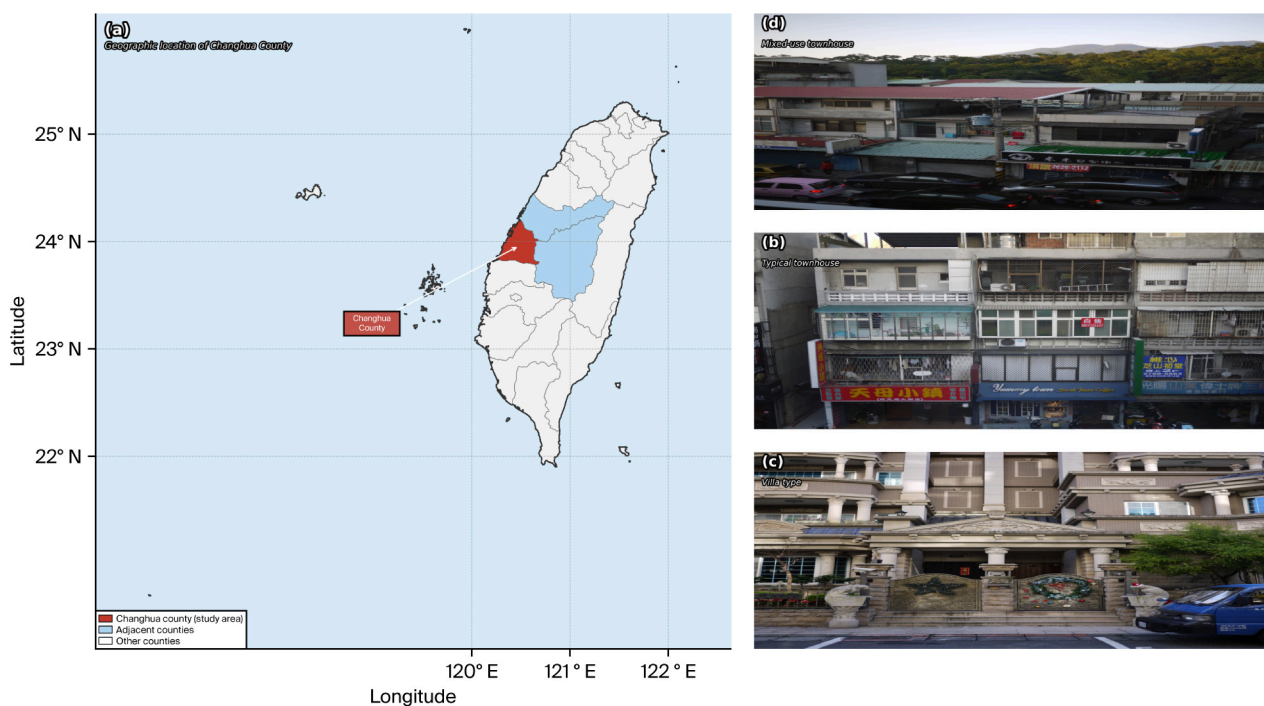


Figure 1. Geographic location of Changhua County and representative low-rise terraced housing investigated in this study. (a) Map of Taiwan showing the location of Changhua County (study area); (b) representative low-rise terraced housing (newly constructed type); (c) representative low-rise terraced housing (street-block type); (d) representative low-rise terraced housing (community type). In panel (a), the red area indicates Changhua County (study area), the light-blue areas indicate adjacent counties, and the white areas indicate all other counties in Taiwan.

3.3. Survey Instrument Development

The survey instrument was developed through a multi-stage process:

Stage 1: Literature Review and Factor Identification: An extensive review of the residential development planning literature identified six core planning dimensions and an initial pool of 25 potential evaluation factors.

Stage 2: Expert Consultation: Semi-structured interviews were conducted with five domain experts (two academic researchers in real estate and construction management, two experienced developers, and one senior construction manager) to refine the factor list, ensure comprehensiveness, and validate relevance to Taiwan's low-rise housing context. This process reduced the factor list to 19 items organized into six dimensions.

Stage 3: Pilot Testing: A pilot survey was administered to 15 respondents (5 from each stakeholder group) to assess question clarity, response time, and preliminary reliability. Minor wording adjustments were made based on pilot feedback.

Stage 4: Final Instrument: The final questionnaire consisted of three sections:

- Section A: Demographic and Background Information: Stakeholder group, age, gender, education, and professional experience (for developers and construction professionals) or homeownership status (for homebuyers).
- Section B: Planning Factor Importance Ratings: Respondents rated the importance of 19 planning factors on a 5-point Likert scale (1 = Not Important, 2 = Slightly Important, 3 = Moderately Important, 4 = Important, 5 = Very Important). The factors were organized into six dimensions:
 - A1. Site Selection (3 factors): A11 Transportation Convenience, A12 Living Amenities, A13 Environmental Quality.
 - A2. Housing Price (3 factors): A21 Total Price, A22 Price Acceptability, A23 Construction Cost.
 - A3. Capital Capacity (2 factors): A31 Homebuyer Financing Capacity, A32 Developer Financing Capacity.
 - A4. Construction Risk (3 factors): A41 Construction Difficulty, A42 Government Regulation, A43 Construction Quality.
 - A5. Building Planning (3 factors): A51 Spatial Efficiency, A52 Functional Layout, A53 Building Appearance.
 - A6. Sustainability Considerations (5 factors): A61 Green Building Certification, A62 Energy Efficiency, A63 Social Inclusion, A64 Governance Transparency, A65 Community Impact.
- Section C: Open-Ended Comments: Respondents were invited to provide additional comments on residential development planning priorities and sustainability considerations.

The questionnaire was administered in Traditional Chinese. All scales and items were translated and back-translated to ensure linguistic equivalence.

3.4. Sampling Strategy and Data Collection

A purposive sampling approach was employed to recruit respondents from three stakeholder groups:

Developers ($n = 37$): Developers were recruited through industry associations (Changhua County Real Estate Development Association), professional networks, and direct contact with firms active in low-rise residential development. The inclusion criteria required current or recent involvement (within past 3 years) in low-rise residential projects in Changhua County. Respondents included company owners, project managers, and senior development staff.

Homebuyers ($n = 92$): Homebuyers were recruited through multiple channels: (1) real estate agencies in Changhua County that provided contact information for recent purchasers of low-rise terraced housing (with informed consent), (2) community networks and social media groups focused on housing in Changhua, and (3) snowball sampling through

initial respondents. The inclusion criteria required purchase of or serious consideration of purchasing a low-rise terraced house in Changhua County within the past 2 years.

Construction Professionals ($n = 47$): Construction professionals were recruited through construction industry associations, contractor firms, and professional networks. The inclusion criteria required current employment in construction management, site supervision, or technical roles with experience in low-rise residential projects in Changhua County. Respondents included project managers, site supervisors, and technical specialists.

Data were collected between March and June 2024 using both online (Google Forms) and paper-based questionnaires, depending on respondent preference. All respondents provided informed consent prior to participation. Because the survey collected only anonymous, non-sensitive questionnaire data with no identifiable personal information and posed minimal risk to participants, formal Institutional Review Board (IRB) review was not required. Ethical review and approval were waived for this study in accordance with applicable national regulations governing low-risk social science surveys.

A total of 200 questionnaires were distributed, with 176 valid responses obtained (response rate: 88.0%). Twenty-four questionnaires were excluded due to incomplete responses (missing more than 10% of items) or inconsistent response patterns (e.g., straight-lining).

The excluded questionnaires were removed prior to statistical analysis. All 19 planning-factor ratings were complete for the 176 valid responses. One homebuyer had a missing value for the background variable Experience/Ownership; this missing demographic value did not affect the principal statistical analyses. Prior to completing the questionnaire, all participants were informed of the study objectives, the voluntary nature of participation, the anonymous handling of responses, and their right to withdraw at any time without consequence.

Sample Size Justification

The adequacy of the sample size was evaluated using both methodological and statistical criteria. A total of 176 valid responses were obtained, comprising 37 developers, 92 homebuyers, and 47 construction professionals. With 19 observed variables, this study provides approximately 9.3 observations per variable ($176/19$), satisfying the commonly recommended criterion of 5–10 observations per variable for exploratory factor analysis. The satisfactory KMO statistic (0.780) and significant Bartlett's test of sphericity further confirmed that the dataset was suitable for multivariate analysis.

To further evaluate statistical adequacy, an a priori power analysis was conducted using G*Power 3.1 for one-way ANOVA with three comparison groups. Assuming a medium effect size (Cohen's $f = 0.25$), a significance level of $\alpha = 0.05$, and statistical power $(1 - \beta) = 0.80$, the required minimum sample size was 158, which was lower than the 176 valid observations obtained in this study. Therefore, the present sample size was considered sufficient for detecting meaningful between-group differences. These results indicate that the sample size was adequate to support both exploratory factor analysis and the subsequent one-way ANOVA.

Because purposive sampling was adopted owing to the limited accessibility of professional stakeholder groups, the findings should be interpreted as exploratory evidence rather than statistically generalizable conclusions. Future studies employing probability sampling and larger multi-regional datasets are encouraged to further strengthen external validity.

3.5. Data Analysis

Data were analyzed using SPSS 26.0 with the following steps:

1. Data Screening and Cleaning: Response patterns were examined for missing data, outliers, and inconsistencies. All 19 planning-factor ratings were complete for the 176 retained valid questionnaires.
2. Reliability Analysis: Internal consistency reliability was assessed using Cronbach's α for each planning dimension and for the overall instrument. Alpha values above 0.70 were considered acceptable.
3. Descriptive Statistics: Means, standard deviations, and frequency distributions were calculated for all variables. Demographic characteristics were compared across stakeholder groups using chi-square tests for categorical variables.
4. Exploratory Factor Analysis (EFA): EFA with principal axis factoring and varimax rotation was conducted to examine the underlying factor structure of the 19 planning factors. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were used to assess data suitability for factor analysis. Factors with eigenvalues greater than 1.0 were retained, and items with factor loadings above 0.40 were considered significant. To assess common method bias, Harman's single-factor test was performed: a single unrotated factor explained 19.0% of the total variance (well below the 50% threshold), indicating that common method variance is unlikely to be a serious concern in this dataset.
5. One-Way ANOVA: One-way analysis of variance was conducted to test for significant differences in importance ratings across the three stakeholder groups for each of the 19 planning factors. Homogeneity of variance was assessed using Levene's test prior to ANOVA. Most factors satisfied the homogeneity assumption. For factors violating Levene's test (A22, A32, A41, A42, A62), Welch ANOVA was additionally checked, and the results remained significant (A22: $F = 6.29, p = 0.003$; A32: $F = 36.91, p < 0.001$; A41: $F = 76.66, p < 0.001$; A42: $F = 74.29, p < 0.001$; A62: $F = 17.13, p < 0.001$), confirming that the conclusions are robust to violations of the homogeneity assumption. Effect sizes were calculated using the eta-squared (η^2) measure, with values of 0.01, 0.06, and 0.14 interpreted as small, medium, and large effects, respectively.
6. Post Hoc Comparisons: Fisher's Least Significant Difference (LSD) test was employed for pairwise comparisons when ANOVA results indicated significant between-group differences. LSD was selected over more conservative tests (e.g., Bonferroni, Tukey) because (1) this study involves planned comparisons among three theoretically distinct groups rather than exploratory data mining, (2) the research questions specifically focus on identifying where differences exist rather than controlling the family-wise error rate across all possible comparisons, and (3) LSD provides appropriate balance between Type I and Type II error for theory-testing research with moderate sample sizes.

To further evaluate the robustness of the principal findings, additional ANCOVA and Tukey HSD analyses were conducted. The Tukey HSD results were fully consistent with those obtained using Fisher's LSD, confirming that the principal stakeholder differences remained statistically significant under a more conservative multiple-comparison procedure.

Furthermore, analyses of covariance (ANCOVA) were conducted for the same five representative planning factors using stakeholder group as the fixed factor and gender, age, and education as covariates. The stakeholder group remained statistically significant for all five factors after controlling for demographic characteristics, demonstrating that the observed cognitive gaps primarily reflected stakeholder roles rather than demographic composition.

7. Cognitive Gap Pattern Analysis: The supply-side (developers + construction professionals) and demand-side (homebuyers) mean ratings were compared to identify systematic patterns of cognitive gaps across planning dimensions.

Statistical significance was set at $\alpha = 0.05$ for all tests. Effect sizes were reported alongside p -values to provide information about practical significance in addition to statistical significance.

4. Results

4.1. Sample Characteristics

Table 1 presents the demographic characteristics of the three stakeholder groups. The sample consisted of 176 respondents: 37 developers (21.0%), 92 homebuyers (52.3%), and 47 construction professionals (26.7%).

Table 1. Demographic characteristics of respondents (N = 176).

Characteristic	Developers (n = 37)	Homebuyers (n = 92)	Construction Professionals (n = 47)	χ^2	p
Gender				11.49	0.003
Male	30 (81.1%)	59 (64.1%)	42 (89.4%)		
Female	7 (18.9%)	33 (35.9%)	5 (10.6%)		
Age				13.02	0.111
20–29	1 (2.7%)	12 (13.0%)	4 (8.5%)		
30–39	11 (29.7%)	38 (41.3%)	19 (40.4%)		
40–49	19 (51.4%)	30 (32.6%)	18 (38.3%)		
50–59	6 (16.2%)	7 (7.6%)	6 (12.8%)		
60+	0 (0.0%)	5 (5.4%)	0 (0.0%)		
Education				15.48	0.017
High school or below	6 (16.2%)	22 (23.9%)	5 (10.6%)		
Associate degree	6 (16.2%)	27 (29.3%)	20 (42.6%)		
Bachelor's degree	18 (48.6%)	39 (42.4%)	19 (40.4%)		
Master's degree or above	7 (18.9%)	4 (4.3%)	3 (6.4%)		
Experience/Ownership				Descriptive comparison only	
<5 years	7 (18.9%)	30 (32.6%) *	10 (21.3%)		
5–10 years	5 (13.5%)	39 (42.4%) *	11 (23.4%)		
10–15 years	18 (48.6%)	12 (13.0%) *	10 (21.3%)		
>15 years	7 (18.9%)	10 (10.9%) *	16 (34.0%)		
Missing		1 (1.1%)			

* Note: For homebuyers, experience refers to years since first home purchase; for developers and construction professionals, experience refers to years in the industry.

Chi-square tests revealed significant differences across stakeholder groups in gender ($\chi^2 = 11.49$, $p = 0.003$) and education ($\chi^2 = 15.48$, $p = 0.017$); age distribution did not differ significantly across groups ($\chi^2 = 13.02$, $p = 0.111$). Construction professionals and developers were predominantly male (89.4% and 81.1%, respectively), while homebuyers showed a more balanced gender distribution (64.1% male). Homebuyers and construction professionals had relatively younger age profiles, with 54.3% and 48.9%, respectively, aged under 40, compared with 32.4% of developers. Developers had the highest educational attainment, with 67.6% holding a bachelor's degree or higher.

4.2. Reliability Analysis

Cronbach's α coefficients were calculated for each planning dimension (Table 2). Most dimensions demonstrated acceptable to good internal consistency. A2 (Housing Price) exhibited relatively low internal consistency (Cronbach's $\alpha = 0.398$). Rather than representing a reflective latent construct, this planning domain was conceptualized as a formative planning domain comprising three conceptually distinct planning considerations: total Housing Price (A21), Price Acceptability (A22), and Construction Cost (A23). These indicators capture different decision perspectives related to housing affordability and cost management and therefore are not expected to exhibit strong internal covariance. Consequently, each indicator was analyzed independently throughout the subsequent statistical analyses rather than interpreted as a single composite scale. A3 (Capital Capacity) was not treated as a single construct: A31 (Homebuyer Financing Capacity) and A32 (Developer Financing Capacity) were analyzed as independent factors reflecting distinct financing perspectives, and no composite α is reported for A3. A5 (Building Planning) demonstrated acceptable reliability ($\alpha = 0.736$) following data cleaning.

Table 2. Reliability analysis results.

Dimension	Number of Items	Cronbach's α
A1. Site Selection	3	0.755
A2. Housing Price	3	0.398
A3. Capital Capacity	2	-
A4. Construction Risk	3	0.753
A5. Building Planning	3	0.736
A6. Sustainability Considerations	5	0.886

Note: A2 (Housing Price) was conceptualized as a formative planning domain comprising conceptually distinct planning considerations rather than a reflective latent construct. A3 (Capital Capacity) is not reported as a single composite because A31 (Homebuyer Financing Capacity) and A32 (Developer Financing Capacity) represent structurally distinct financing perspectives and are analyzed independently throughout the study.

4.3. Exploratory Factor Analysis

Exploratory factor analysis (EFA) was conducted to examine the underlying factor structure of the 19 planning factors. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.780, indicating that the data were suitable for factor analysis. Bartlett's test of sphericity was significant ($\chi^2 = 1226.69$, $df = 171$, $p < 0.001$), confirming that correlations among items were sufficiently large for EFA. Common method bias was assessed using Harman's single-factor test; the first unrotated factor accounted for 19.0% of total variance, well below the 50% threshold, suggesting that common method variance does not substantially distort the findings. The factor structure was conceptually specified before data collection and subsequently validated through EFA. The rotated factor matrix is presented in Table 3.

Table 3. Exploratory factor analysis: rotated factor matrix.

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Communality
Factor 1: Site Selection							
A11 Transportation Convenience	0.634 *	0.288	−0.245	−0.221	0.160	0.136	0.638
A12 Living Amenities	0.816 *	−0.013	−0.142	−0.126	0.060	0.081	0.713
A13 Environmental Quality	0.823 *	−0.054	0.082	0.029	0.033	0.094	0.697

Table 3. Cont.

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Communality
Factor 2: Housing Price							
A21 Total Price	0.027	0.788 *	−0.148	−0.060	0.084	0.005	0.654
A22 Price Acceptability	−0.015	0.792 *	0.035	−0.103	0.062	−0.021	0.643
A23 Construction Cost	−0.379	0.228	0.274	0.379	−0.237	−0.037	0.473
Factor 3: Capital Capacity							
A31 Homebuyer Financing	0.347	0.389	0.383	−0.326	−0.012	0.191	0.561
A32 Developer Financing	−0.108	−0.075	0.861 *	0.152	−0.039	−0.043	0.786
Factor 4: Construction Risk							
A41 Construction Difficulty	−0.121	−0.164	0.134	0.853 *	−0.088	−0.025	0.796
A42 Government Regulation	−0.159	−0.099	0.151	0.846 *	−0.136	−0.176	0.822
A43 Construction Quality	0.229	0.173	−0.334	0.664 *	−0.018	0.039	0.637
Factor 5: Building Planning							
A51 Spatial Efficiency	0.210	0.162	−0.043	−0.117	0.756 *	0.082	0.664
A52 Functional Layout	−0.043	0.093	−0.058	−0.194	0.801 *	0.104	0.705
A53 Building Appearance	0.111	−0.273	0.077	0.080	0.580 *	−0.050	0.438
Factor 6: Sustainability							
A61 Green Building Certification	0.090	0.029	−0.102	−0.065	0.025	0.832 *	0.716
A62 Energy Efficiency	0.277	0.008	0.003	−0.131	0.095	0.755 *	0.673
A63 Social Inclusion	0.005	−0.076	0.011	−0.004	0.037	0.842 *	0.716
A64 Governance Transparency ‡	0.052	−0.002	0.028	0.015	0.001	0.869 *	0.758
A65 Community Impact	−0.022	0.094	−0.013	−0.125	0.070	0.800 *	0.671
Eigenvalue	2.70	2.43	2.20	1.98	1.86	1.60	
% Variance Explained	14.2%	12.8%	11.6%	10.4%	9.8%	8.4%	
Cumulative %	14.2%	27.0%	38.6%	49.0%	58.8%	67.2%	

* Primary factor loading. ‡ A64 shows high communality (0.758) within Factor 6; the non-significant ANOVA ($p = 0.168$) indicates that while A64 loads strongly on the sustainability factor, between-group differences in governance transparency perceptions have not yet crystallized.

The EFA results confirm that the six-dimension conceptual framework is empirically supported. The six factors collectively explained 67.2% of the total variance ($KMO = 0.780$, Bartlett's $\chi^2 = 1226.69$, $p < 0.001$). Items were refined through expert consultation and pilot testing prior to full-scale administration, which likely contributed to the clean factor structure observed. Most items loaded primarily on their intended factors with loadings exceeding 0.56. A23 and A31 showed weaker or cross-loading patterns and were retained as theoretically important bridging items rather than as strong reflective indicators. This interpretation is consistent with treating the Housing Price domain as a formative planning domain rather than a reflective latent construct, since A23 serves as a theoretically meaningful bridging indicator linking housing affordability and construction risk. The sustainability dimension (Factor 6) emerged as a distinct factor, indicating that respondents perceive sustainability-related considerations as a coherent planning dimension separate from traditional factors.

Notably, A23 (Construction Cost) exhibited modest cross-loading across factors, suggesting that construction cost is conceptually linked to both pricing and risk considerations; however, its communality (0.473) remained acceptable, and the item was retained within its primary factor.

4.4. Descriptive Statistics and Anova Results

Table 4 presents the descriptive statistics (means and standard deviations) for each planning factor by stakeholder group, along with the results of one-way ANOVA testing for between-group differences.

Table 4. Descriptive statistics and ANOVA results for planning factors.

Dimension	Factor	Developers (<i>n</i> = 37) M (SD)	Homebuyers (<i>n</i> = 92) M (SD)	Construction Prof. (<i>n</i> = 47) M (SD)	F	<i>p</i>	η^2
A1. Site Selection							
	A11 Transportation Convenience	3.89 (0.66)	4.73 (0.45)	3.96 (0.75)	40.82	<0.001	0.321
	A12 Living Amenities	3.97 (0.73)	4.49 (0.58)	3.83 (0.84)	16.79	<0.001	0.163
	A13 Environmental Quality	3.92 (0.72)	4.29 (0.64)	4.04 (0.69)	4.91	0.008	0.054
A2. Housing Price							
	A21 Total Price	4.16 (0.76)	4.64 (0.55)	4.11 (0.81)	12.65	<0.001	0.128
	A22 Price Acceptability	4.35 (0.68)	4.63 (0.55)	4.23 (0.76)	6.77	0.001	0.073
	A23 Construction Cost	4.65 (0.54)	3.86 (0.76)	4.62 (0.57)	28.80	<0.001	0.250
A3. Capital Capacity							
	A31 Homebuyer Financing Capacity	3.86 (0.86)	4.52 (0.62)	3.98 (0.74)	15.76	<0.001	0.154
	A32 Developer Financing Capacity	4.70 (0.46)	3.70 (0.86)	4.40 (0.68)	29.42	<0.001	0.254
A4. Construction Risk							
	A41 Construction Difficulty	4.38 (0.64)	3.27 (0.80)	4.64 (0.53)	70.84	<0.001	0.450
	A42 Government Regulation	4.59 (0.50)	3.39 (0.80)	4.64 (0.53)	71.89	<0.001	0.454
	A43 Construction Quality	4.43 (0.60)	4.51 (0.58)	4.47 (0.62)	0.25	0.781	0.003
A5. Building Planning							
	A51 Spatial Efficiency	4.08 (0.72)	4.60 (0.49)	4.17 (0.70)	13.26	<0.001	0.133
	A52 Functional Layout	4.16 (0.73)	4.62 (0.51)	4.21 (0.69)	10.90	<0.001	0.112
	A53 Building Appearance	3.84 (0.83)	4.15 (0.73)	3.94 (0.79)	2.68	0.071	0.030
A6. Sustainability Considerations							
	A61 Green Building Certification	3.49 (0.87)	4.08 (0.77)	3.57 (0.85)	9.75	<0.001	0.101
	A62 Energy Efficiency	3.59 (0.90)	4.37 (0.66)	3.74 (0.87)	17.95	<0.001	0.172
	A63 Social Inclusion	3.32 (0.94)	3.71 (0.86)	3.45 (0.85)	3.02	0.052	0.034
	A64 Governance Transparency	3.19 (0.97)	3.50 (0.91)	3.28 (0.97)	1.80	0.168	0.020
	A65 Community Impact	3.38 (0.86)	3.98 (0.80)	3.60 (0.88)	7.95	<0.001	0.084

Note: M = mean; SD = standard deviation; η^2 = eta-squared effect size. Significance level: $p < 0.05$.

ANOVA results revealed significant between-group differences for 15 of 19 planning factors ($p < 0.05$). Four factors showed non-significant differences: A43 Construction Quality ($F = 0.25$, $p = 0.781$), A53 Building Appearance ($F = 2.68$, $p = 0.071$), A63 Social Inclusion ($F = 3.02$, $p = 0.052$), and A64 Governance Transparency ($F = 1.80$, $p = 0.168$). Effect sizes ranged from small ($\eta^2 = 0.020$ for A64 Governance Transparency) to large ($\eta^2 = 0.454$ for A42 Government Regulation).

The construction risk dimension exhibited the largest effect sizes, with A41 Construction Difficulty ($\eta^2 = 0.450$) and A42 Government Regulation ($\eta^2 = 0.454$) showing particularly pronounced cognitive gaps. Within the sustainability dimension, A62 Energy Efficiency showed a large effect size ($\eta^2 = 0.172$), while A61 Green Building Certification ($\eta^2 = 0.101$) and A65 Community Impact ($\eta^2 = 0.084$) showed medium effect sizes.

4.5. Robustness Analyses

To further verify the stability of the statistical findings, additional robustness analyses were performed. First, ANCOVA analyses controlling for gender, age, and education were

conducted for the five representative planning factors (A23, A32, A41, A42, and A62). The stakeholder group remained statistically significant for all five factors (all $p < 0.001$), whereas demographic covariates were generally non-significant.

Second, Tukey's HSD post hoc comparisons were performed for the same five representative planning factors. The Tukey HSD results supported conclusions fully consistent with those obtained using Fisher's LSD, indicating that the principal stakeholder differences remained statistically significant under a more conservative multiple-comparison procedure. These robustness analyses support the stability of the principal findings and provide additional evidence that the observed stakeholder cognitive gaps are not artifacts of demographic imbalance or post hoc comparison selection.

Table 5 summarizes the results of the robustness analyses, including ANCOVA and Tukey's HSD.

Table 5. Summary of robustness analyses (ANCOVA and Tukey HSD).

Planning Factor	ANCOVA (F, p)	Tukey HSD	Interpretation
A23 Construction Cost	F = 23.46, $p < 0.001$	Consistent with LSD	Robust
A32 Developer Financing Capacity	F = 28.92, $p < 0.001$	Consistent with LSD	Robust
A41 Construction Difficulty	F = 59.38, $p < 0.001$	Consistent with LSD	Robust
A42 Government Regulation	F = 62.32, $p < 0.001$	Consistent with LSD	Robust
A62 Energy Efficiency	F = 18.16, $p < 0.001$	Consistent with LSD	Robust

Note: ANCOVA controlled for gender, age, and education. Tukey's HSD results were fully consistent with Fisher's LSD, indicating that the principal conclusions remained unchanged under a more conservative post hoc procedure.

4.6. Post Hoc Comparisons

Fisher's LSD post hoc tests were conducted for all factors with significant ANOVA results to identify specific pairwise differences among stakeholder groups. Table 6 summarizes Fisher's LSD post hoc comparison results.

Table 6. Fisher's LSD post hoc comparison results.

Dimension	Factor	Developer vs. Homebuyer Mean Diff.	Developer vs. Construction Prof. Mean Diff.	Homebuyer vs. Construction Prof. Mean Diff.
	A1. Site Selection			
	A11 Transportation Convenience	−0.84 ***	−0.07	+0.77 ***
	A12 Living Amenities	−0.52 ***	+0.14	+0.66 ***
	A13 Environmental Quality	−0.37 **	−0.12	+0.25 *
	A2. Housing Price			
	A21 Total Price	−0.48 ***	+0.06	+0.53 ***
	A22 Price Acceptability	−0.28 *	+0.12	+0.40 ***
	A23 Construction Cost	+0.79 ***	+0.03	−0.76 ***
	A3. Capital Capacity			
	A31 Homebuyer Financing Capacity	−0.66 ***	−0.11	+0.54 ***
	A32 Developer Financing Capacity	+1.01 ***	+0.30	−0.71 ***
	A4. Construction Risk			
	A41 Construction Difficulty	+1.11 ***	−0.26	−1.37 ***
	A42 Government Regulation	+1.20 ***	−0.04	−1.25 ***
	A43 Construction Quality	−0.08	−0.04	+0.04
	A5. Building Planning			
	A51 Spatial Efficiency	−0.52 ***	−0.09	+0.43 ***
	A52 Functional Layout	−0.46 ***	−0.05	+0.41 ***
	A53 Building Appearance	−0.31	−0.10	+0.22

Table 6. Cont.

Dimension	Factor	Developer vs. Homebuyer Mean Diff.	Developer vs. Construction Prof. Mean Diff.	Homebuyer vs. Construction Prof. Mean Diff.
A6. Sustainability				
A61 Green Building Certification		−0.59 ***	−0.09	+0.50 ***
A62 Energy Efficiency		−0.77 ***	−0.15	+0.62 ***
A63 Social Inclusion		−0.38	−0.12	+0.26
A64 Governance Transparency		−0.31	−0.09	+0.22
A65 Community Impact		−0.60 ***	−0.22	+0.38 *

Note: Mean Diff. = mean of the first group minus mean of the second group in each comparison heading. Positive values indicate that the first group rated the factor higher than the second group. Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Several clear patterns emerged from the post hoc comparisons:

1. Developer vs. Homebuyer Differences: Homebuyers rated the following significantly higher than developers:
 - All Site Selection factors (A11, A12, A13).
 - Housing Price factors (A21 Total Price, A22 Price Acceptability).
 - Homebuyer financing capacity (A31).
 - Building planning factors A51 (Spatial Efficiency) and A52 (Functional Layout) showed significant differences; A53 (Building Appearance) showed a non-significant difference ($p = 0.071$, $\Delta = 0.26$) and is classified in the Consensus Zone.
 - Green Building Certification, Energy Efficiency, and Community Impact (A61, A62, and A65).

Developers rated the following significantly higher than homebuyers:

- Construction Cost (A23).
 - Developer Financing Capacity (A32).
 - Construction difficulty (A41).
 - Government regulation (A42).
2. Construction Professional vs. Homebuyer Differences: Construction professionals rated the following significantly higher than homebuyers:
 - Construction Cost (A23).
 - Construction difficulty (A41).
 - Government regulation (A42).

Homebuyers rated the following significantly higher than construction professionals:

- All Site Selection factors (A11, A12, A13).
 - Housing Price factors (A21, A22).
 - Homebuyer financing capacity (A31).
 - Building planning factors A51 (Spatial Efficiency) and A52 (Functional Layout); A53 (Building Appearance) showed a non-significant difference ($p = 0.071$, $\Delta = 0.26$) and is classified in the Consensus Zone.
 - Green Building Certification, Energy Efficiency, and Community Impact (A61, A62, and A65).
3. Developer vs. Construction Professional Differences: Relatively few differences emerged between developers and construction professionals, suggesting that these two supply-side groups shared broadly similar cognitive frames. No pairwise difference between these two groups reached statistical significance at the 0.05 level.

4.7. Supply-Side vs. Demand-Side Cognitive Gap Patterns

To further examine systematic cognitive gaps, we compared aggregate supply-side (developers + construction professionals, $n = 84$) and demand-side (homebuyers, $n = 92$) mean ratings. Figure 2 presents the aggregate mean ratings for all 19 planning factors, illustrating the systematic divergence between supply- and demand-side perceptions across the six planning dimensions.

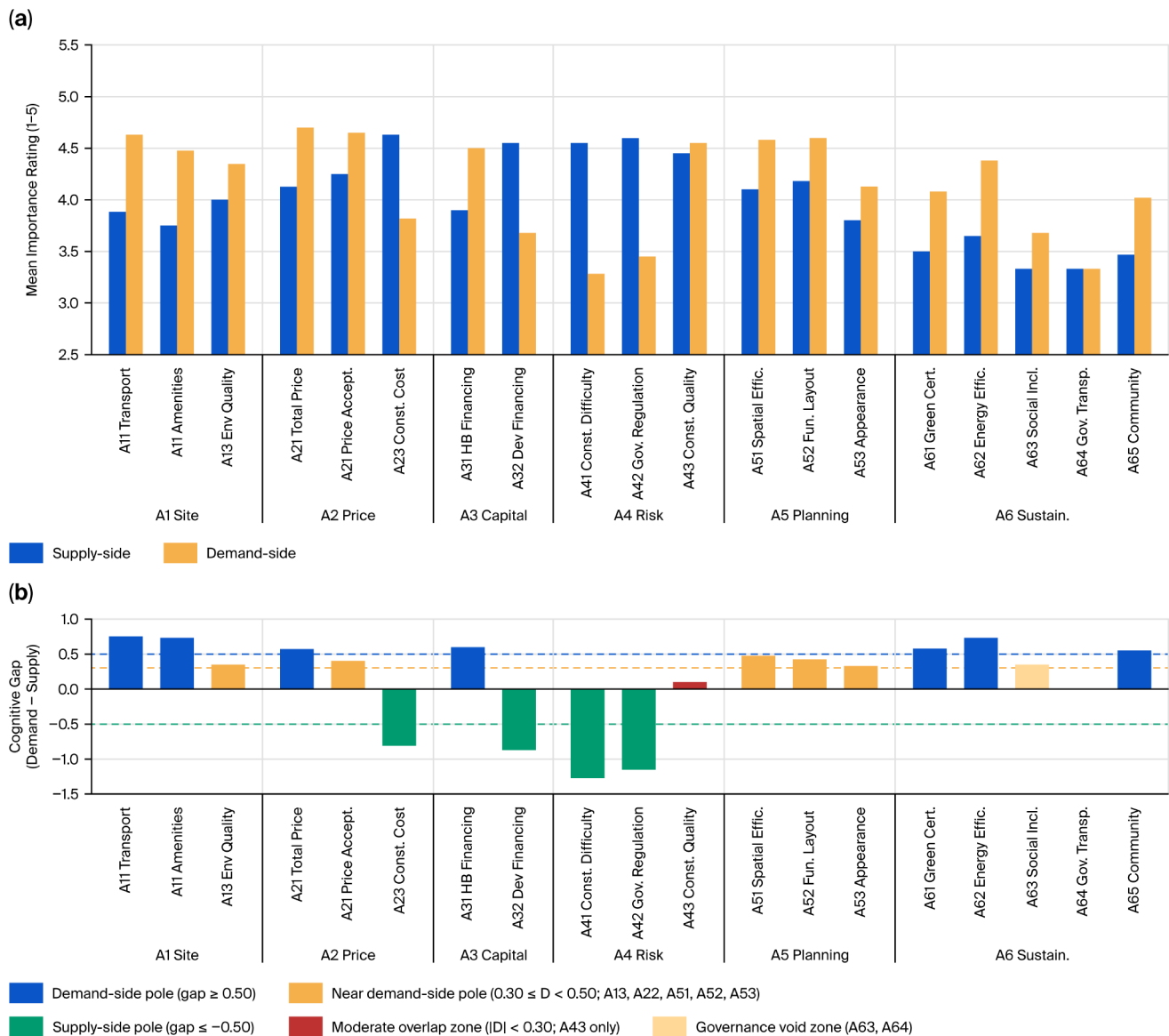


Figure 2. Supply-side versus demand-side mean ratings across 19 planning factors. (a) Grouped bar chart comparing mean importance ratings. (b) Cognitive gap (demand – supply) with color-coded zones. In panel (b), the dashed horizontal lines indicate the cognitive-gap thresholds ($\Delta = \pm 0.50$) used to distinguish the supply-side and demand-side cognitive poles.

Supply-Side Cognitive Pole (factors where supply-side ratings exceed demand-side ratings by ≥ 0.50 points):

- A23 Construction Cost (Supply M = 4.63, Demand M = 3.86, $\Delta = -0.77$);
- A32 Developer Financing Capacity (Supply M = 4.54, Demand M = 3.70, $\Delta = -0.84$);
- A41 Construction Difficulty (Supply M = 4.52, Demand M = 3.27, $\Delta = -1.25$);
- A42 Government Regulation (Supply M = 4.62, Demand M = 3.39, $\Delta = -1.23$).

Demand-Side Cognitive Pole (factors where demand-side ratings exceed supply-side ratings by ≥ 0.50 points):

- A11 Transportation Convenience (Demand M = 4.73, Supply M = 3.93, $\Delta = 0.80$);
- A12 Living Amenities (Demand M = 4.49, Supply M = 3.89, $\Delta = 0.60$);
- A21 Total Price (Demand M = 4.64, Supply M = 4.13, $\Delta = 0.51$);
- A31 Homebuyer Financing Capacity (Demand M = 4.52, Supply M = 3.93, $\Delta = 0.59$);
- A61 Green Building Certification (Demand M = 4.08, Supply M = 3.54, $\Delta = 0.54$);
- A62 Energy Efficiency (Demand M = 4.37, Supply M = 3.68, $\Delta = 0.69$).

Near Demand-Side Pole (factors where demand-side ratings exceed supply-side ratings by 0.30–0.49 points):

- A51 Spatial Efficiency (Demand M = 4.60, Supply M = 4.13, $\Delta = 0.47$);
- A52 Functional Layout (Demand M = 4.62, Supply M = 4.19, $\Delta = 0.43$);
- A65 Community Impact (Demand M = 3.98, Supply M = 3.50, $\Delta = 0.48$);
- A13 Environmental Quality (Demand M = 4.29, Supply M = 3.99, $\Delta = 0.31$);
- A22 Price Acceptability (Demand M = 4.63, Supply M = 4.29, $\Delta = 0.34$).

Cognitive Overlap/Consensus Zone ($|\Delta| < 0.30$ —near consensus):

- A43 Construction Quality (Demand M = 4.51, Supply M = 4.45, $\Delta = 0.06$);
- A53 Building Appearance (Demand M = 4.15, Supply M = 3.89, $\Delta = 0.26$).
- Emerging Governance Awareness Zone (factors with marginal or non-significant ANOVA results and minimal effect sizes, indicating nascent institutional awareness not yet crystallized into differentiated stakeholder positions):
- A63 Social Inclusion ($F = 3.02$, $p = 0.052$, $\eta^2 = 0.034$). Although A63 approached statistical significance ($p = 0.052$), the effect size remained very small ($\eta^2 = 0.034$), indicating only weak differentiation among stakeholder groups.
- A64 Governance Transparency ($F = 1.80$, $p = 0.168$, $\eta^2 = 0.020$).

This pattern analysis reveals systematic cognitive gaps aligned with the conceptual framework.

5. Discussion

5.1. Overall Findings

We investigated stakeholder cognitive gaps in residential development planning in Taiwan's low-rise housing sector, examining perception differences among developers, homebuyers, and construction professionals across 19 planning factors organized into six dimensions. The results reveal systematic and substantial cognitive gaps between supply- and demand-side stakeholders, with 15 of 19 factors showing significant between-group differences ($p < 0.05$) and effect sizes ranging from small to large ($\eta^2 = 0.020$ to 0.454).

Three overarching patterns emerged:

First, supply-side stakeholders (developers and construction professionals) consistently prioritized factors related to cost control (A23 Construction Cost), risk management (A41 Construction Difficulty, A42 Government Regulation), and financing capacity (A32 Developer Financing Capacity). These priorities reflect supply-side actors' focus on project feasibility, operational execution, and liability management.

Second, demand-side stakeholders (homebuyers) consistently prioritized factors related to location quality (A11 Transportation Convenience, A12 Living Amenities), spatial functionality (A51 Spatial Efficiency, A52 Functional Layout), and sustainability attributes (A61 Green Building Certification, A62 Energy Efficiency) as well as near demand-side factors (A65 Community Impact, $\Delta = 0.48$).

These priorities reflect demand-side actors' focus on long-term occupancy, quality of life, and investment value.

Third, sustainability-related considerations emerged as a particularly pronounced area of cognitive divergence, with homebuyers rating green building certification, energy efficiency, and community impact significantly higher than supply-side stakeholders, while governance transparency showed non-significant differences across all groups—suggesting an institutional void in governance awareness.

The following subsections discuss each pattern in turn, drawing on the structural characteristics identified in Section 5.5.

The Stakeholder Cognitive Gap Framework (SCGF) proposed in this study offers a conceptual and diagnostic perspective for organizing and interpreting these perception patterns. The framework is grounded in three structural characteristics—time horizon, risk exposure, and information endowment differences—that consistently shape supply–demand divergence across planning dimensions.

5.2. Supply-Side Cognitive Differences

5.2.1. Government Regulation and Construction Risk (A41, A42)

Government Regulation (A42) exhibited one of the largest cognitive gaps in the study, with supply-side stakeholders rating it significantly higher than homebuyers (Supply $M = 4.62$, Demand $M = 3.39$, $\Delta = -1.23$, $F = 71.89$, $p < 0.001$, $\eta^2 = 0.454$). This pronounced divergence reflects fundamental differences in regulatory exposure and liability between supply- and demand-side actors.

5.2.2. Construction Difficulty (A41)

Construction Difficulty (A41) showed the largest absolute cognitive gap in the study, with construction professionals rating it highest ($M = 4.64$), followed by developers ($M = 4.38$), while homebuyers rated it substantially lower ($M = 3.27$) ($F = 70.84$, $p < 0.001$, $\eta^2 = 0.450$). This pattern reflects the direct operational consequences that construction professionals face in project execution.

Developers occupy an intermediate position ($M = 4.38$), managing construction risk at portfolio level, while homebuyers ($M = 3.27$) purchase through presale contracts with limited construction visibility. Homebuyers evaluate difficulty through outcomes—schedule adherence and quality—rather than as an independent planning factor. These findings are consistent with classical construction risk management theory, which identifies technical uncertainty and operational complexity as primary determinants of project risk [17]. These findings also reinforce previous research emphasizing that effective construction performance depends on early-stage risk identification and systematic assessment during project planning [18]. These findings are also consistent with empirical evidence demonstrating that construction risk is multidimensional, encompassing technical, managerial, regulatory, and operational uncertainties throughout project execution [19].

5.2.3. Construction Cost and Financing Capacity (A23, A32)

Construction Cost (A23) and Developer Financing Capacity (A32) both showed substantial supply–demand cognitive gaps, with supply-side stakeholders rating both factors significantly higher than homebuyers (A23: Supply $M = 4.63$, Demand $M = 3.86$, $\Delta = -0.77$, $F = 28.80$, $p < 0.001$; A32: Supply $M = 4.54$, Demand $M = 3.70$, $\Delta = -0.84$, $F = 29.42$, $p < 0.001$).

For developers, construction cost and financing capacity are fundamental determinants of project financial feasibility. Residential development operates on relatively thin margins in Taiwan's secondary cities, making cost control a primary optimization criterion.

Homebuyers experience construction cost indirectly through Housing Price (A21: $M = 4.64$, the highest-rated factor among homebuyers), and evaluate it over a 20–30+ year lifecycle, while supply-side actors optimize over a 2–4 year project cycle.

5.3. Demand-Side Cognitive Differences

5.3.1. Location Quality: Transportation and Living Amenities (A11, A12)

Transportation Convenience (A11) and Living Amenities (A12) both showed substantial demand-side cognitive gaps, with homebuyers rating both factors significantly higher than supply-side stakeholders (A11: Demand $M = 4.73$, Supply $M = 3.93$, $\Delta = 0.80$, $F = 40.82$, $p < 0.001$; A12: Demand $M = 4.49$, Supply $M = 3.89$, $\Delta = 0.60$, $F = 16.79$, $p < 0.001$).

Location quality fundamentally shapes homebuyers' daily quality of life across long occupancy horizons. Transportation convenience affects daily commuting, employment access, and mobility costs, while living amenities, including schools, healthcare, retail, and recreation, determine access to essential services. These attributes are experienced daily over 20–30+ year occupancy periods, creating substantial cumulative impact on homebuyer welfare. Critically, location is the most permanent and irreversible housing attribute: homebuyers can renovate interiors or upgrade appliances, but they cannot change location without incurring the full transaction and displacement costs of relocation. This irreversibility amplifies location's weight in homebuyer decision-making relative to supply-side stakeholders, who evaluate location primarily through land cost and marketability rather than lived experience. This observation is consistent with urban economics research emphasizing the enduring influence of residential location on housing value and urban development patterns [24]. These findings are also consistent with hedonic pricing research showing that location, accessibility, and neighborhood attributes are among the strongest determinants of residential property value [25]. These findings are also consistent with recent homebuyer preference research demonstrating that buyers systematically prioritize location, functional layout, and sustainable residential features during housing selection [22].

5.3.2. Spatial Quality: Efficiency and Functional Layout (A51, A52)

Spatial Efficiency (A51) and Functional Layout (A52) both showed demand-side cognitive gaps, with homebuyers rating both factors significantly higher than supply-side stakeholders (A51: Demand $M = 4.60$, Supply $M = 4.13$, $\Delta = 0.47$, $F = 13.26$, $p < 0.001$; A52: Demand $M = 4.62$, Supply $M = 4.19$, $\Delta = 0.43$, $F = 10.90$, $p < 0.001$).

Daily Functional Experience: Spatial efficiency and functional layout determine how effectively homebuyers can use their living space for daily activities—cooking, dining, sleeping, working, entertaining, storage, and circulation. Poor spatial efficiency creates wasted space, awkward circulation patterns, and functional constraints that homebuyers experience daily over long occupancy periods. Effective functional layout enhances daily convenience, supports diverse activities, and adapts to changing household needs over time. These findings are consistent with previous Taiwan-based evidence demonstrating that housing design quality and service planning substantially influence residential development quality and user satisfaction [23].

5.3.3. Sustainability Preferences: Green Building and Energy Efficiency (A61, A62)

Green Building Certification (A61) and Energy Efficiency (A62) both showed substantial demand-side cognitive gaps, with homebuyers rating both factors significantly higher than supply-side stakeholders (A61: Demand $M = 4.08$, Supply $M = 3.54$, $\Delta = 0.54$, $F = 9.75$, $p < 0.001$; A62: Demand $M = 4.37$, Supply $M = 3.68$, $\Delta = 0.69$, $F = 17.95$, $p < 0.001$).

Taiwan's EEWB and LEED certification systems reduce information asymmetry by providing third-party verification of environmental performance; as homebuyers lack technical knowledge to assess energy performance independently, certification is viewed as a credible quality signal. This information asymmetry prevents homebuyers from fully

evaluating latent environmental quality attributes, consistent with Akerlof's theory of quality uncertainty [14].

Split Incentive Problem and Policy Implications: The energy efficiency perception gap exemplifies the green technology adoption barriers identified by Chan et al. [40]. Developers bear upfront costs of energy efficiency investments but do not capture long-term operational cost savings, creating systematic underinvestment. Homebuyers value energy efficiency and are willing to pay premiums, but information asymmetry and market failures prevent efficient price signaling.

Rebound Effects and Behavioral Considerations: Research has documented two related challenges. First, offering energy-saving features can increase homebuyer preference for larger homes through rebound mechanisms including income effects and moral-licensing behavior, potentially nullifying environmental benefits [41]. Second, the energy paradox suggests that market failures and split incentives may prevent economically efficient adoption of energy-saving technologies [33]. These findings suggest that energy efficiency gains may be partially offset by increased consumption or adoption barriers, complicating the relationship between green features and actual sustainability outcomes.

5.3.4. Governance Transparency: The Emerging Governance Awareness Zone (A64)

Institutional Void and Nascent Governance Awareness: The non-significant result for governance transparency reflects an institutional void—the absence of well-developed institutional frameworks, norms, and enforcement mechanisms for ESG governance in Taiwan's residential development sector [5,34]. Unlike environmental compliance (building codes, energy standards) and social considerations (accessibility requirements), governance transparency lacks clear regulatory mandates, standardized metrics, or enforcement mechanisms in Taiwan's housing sector [34].

The EFA results provide an important nuance: A64 showed high communality (0.758) within Factor 6, indicating that governance transparency is conceptually well aligned with the sustainability dimension and loads strongly on the same factor as green building certification, energy efficiency, social inclusion, and community impact. The non-significant ANOVA result ($F = 1.80$, $p = 0.168$) therefore does not reflect construct ambiguity; rather, it reflects that all three stakeholder groups share similarly low awareness of governance transparency, producing no between-group differentiation. This pattern—high construct coherence combined with uniformly nascent awareness—is consistent with the concept of institutional voids.

Interpretation of the Findings:

These findings have important policy implications: advancing governance transparency in residential development requires institutional development, encompassing regulatory mandates, standardized disclosure frameworks, enforcement mechanisms, and stakeholder education, rather than relying on voluntary market-driven adoption. The governance void cannot be filled through market mechanisms alone but requires coordinated institutional intervention.

5.4. Sustainability and Esg Transition

A central finding of this study is the uneven integration of ESG dimensions in Taiwan's low-rise residential housing sector. The empirical results reveal a clear hierarchy: environmental (E) factors are strongly salient, social (S) considerations are emerging, and governance (G) transparency remains institutionally underdeveloped [7,34].

Within the sustainability dimension (A6), the environmental factors—Green Building Certification (A61: $F = 9.75$, $p < 0.001$, $\eta^2 = 0.101$) and Energy Efficiency (A62: $F = 17.95$, $p < 0.001$, $\eta^2 = 0.172$)—demonstrated significant between-group differences with medium-

to-large effect sizes, confirming that environmental sustainability has become a salient and differentiated concern among residential development stakeholders in Taiwan.

Community Impact (A65: $F = 7.95$, $p < 0.001$, $\eta^2 = 0.084$), which bridges environmental and social dimensions, also showed significant differentiation. By contrast, Social Inclusion (A63: $F = 3.02$, $p = 0.052$, $\eta^2 = 0.034$) approached significance with a small effect size, and Governance Transparency (A64: $F = 1.80$, $p = 0.168$, $\eta^2 = 0.020$) was non-significant, indicating that social and governance considerations remain emerging concepts that have not yet crystallized into clearly differentiated stakeholder perceptions.

This observed $E > S > G$ hierarchy is analytically coherent with the current institutional maturity of Taiwan's residential development sector.

Social sustainability, by contrast, lacks equivalent institutional anchors in Taiwan's low-rise housing sector. Universal design requirements exist under Taiwan's accessibility design specifications, but are weakly enforced in low-rise terraced housing [30,42]. The marginal significance of A63 ($p = 0.052$) suggests an emerging transition: awareness is growing, particularly among homebuyers, but differentiation remains nascent [13].

Governance transparency represents the deepest institutional void. Unlike environmental compliance (which has measurable certification and rating systems) and social considerations (which have nascent regulatory frameworks), governance transparency in Taiwan's small-to-medium developer sector lacks regulatory mandates, standardized disclosure frameworks, or enforcement mechanisms [5,34]. Georgiadou and Ionica [34] demonstrate that ESG integration in residential real estate remains uneven, with governance dimensions lagging substantially behind environmental compliance—a pattern directly consistent with the non-significant result for A64 ($F = 1.80$, $p = 0.168$) observed in this study.

Abuzaid et al. [36] similarly find that sustainability perception gaps among building occupants are most pronounced for governance transparency dimensions, where institutional reference points are absent, reinforcing the Emerging Governance Awareness Zone classification in our framework—a zone defined not by stakeholder indifference but by the absence of sufficiently developed institutional anchors to generate measurable inter-group divergence.

Simulation studies further suggest that improvements in residential energy efficiency and green residence adoption require coordinated policy support and long-term planning mechanisms [28].

5.5. Interpretation Through the Stakeholder Cognitive Gap Framework (Scgf)

The empirical findings reveal a systematic supply–demand cognitive gap pattern rooted in structural differences between supply- and demand-side actors, consistent with sensemaking theory [16]. This section interprets the observed patterns through the SCGF, which organizes planning factors into five analytical zones.

5.5.1. Structural Characteristics Driving Cognitive Gaps

Three structural drivers create systematic cognitive gaps between supply- and demand-side stakeholders:

1. Time Horizon Differences: Supply-side stakeholders (developers and construction professionals) operate on short-to-medium project horizons, while demand-side stakeholders (homebuyers) operate on long-term occupancy horizons. This temporal divergence creates different optimization criteria:
 - Supply-side optimization: Maximize project financial performance (profit margin, sales velocity) over the project cycle. This optimization prioritizes cost control, risk management, and regulatory compliance—factors that directly determine project feasibility and profitability.

- Demand-side optimization: Maximize occupancy value (quality of life, lifecycle costs, investment value) over the occupancy horizon. This optimization prioritizes location quality, spatial functionality, and sustainability attributes—factors that determine long-term occupancy satisfaction and property value.
2. Risk Exposure Differences: Supply- and demand-side stakeholders face different types and magnitudes of risk:
 - Supply-side risk exposure: Financial risk (project profitability, financing costs), operational risk (construction delays, quality defects), regulatory risk (code compliance, permit approvals), and liability risk (warranty claims, safety violations). These risks are concentrated during the project execution phase and are directly controllable through management decisions.
 - Demand-side risk exposure: Location risk (neighborhood change, accessibility), quality risk (building defects, durability), financial risk (mortgage burden, property value), and lifecycle risk (energy costs, maintenance costs, adaptability to changing needs). These risks are distributed over long occupancy periods and are largely determined by initial purchase decisions.
 - These distinct risk profiles are consistent with integrated risk management theory, which emphasizes that strategic decisions are shaped by different categories of risk exposure and organizational objectives [21].
 3. Information Endowment Differences: Supply- and demand-side stakeholders possess different types and levels of information:
 - Supply-side information endowments: Technical knowledge (construction methods, materials, building systems), regulatory knowledge (building codes, permit processes, compliance requirements), cost knowledge (construction, land, financing costs), and market knowledge (pricing, sales velocity, competitive positioning). This specialized knowledge is acquired through professional training and repeated project experience.
 - Demand-side information endowments: Preference knowledge (household needs, lifestyle priorities, budget constraints), experiential knowledge (daily living patterns, neighborhood quality, commuting patterns), and market knowledge (property values, neighborhood trends, investment potential). This knowledge is personalized and experience-based rather than technical and professional.

5.5.2. Scgf Analytical Zones

Drawing on these structural characteristics, the SCGF organizes planning factors into five analytical zones that reflect the degree and direction of supply–demand perception divergence:

Zone 1: Supply-Side Cognitive Pole.

Analytical Interpretation: Supply-side stakeholders (developers and construction professionals) share a common cognitive orientation centered on cost control, risk mitigation, and financing feasibility. This convergence reflects shared professional exposure to project-level financial constraints and regulatory liability. The clustering of construction risk (A41, A42) and capital capacity (A31, A32) factors in this pole confirms that supply-side cognition is structured primarily around production-side imperatives rather than end-user experience.

Zone 2: Demand-Side Cognitive Pole.

Analytical Interpretation: Homebuyers consistently assign higher importance to location quality (A11, A12), sustainability attributes (A61, A62), and spatial functionality (A51, A52) compared to supply-side stakeholders. This Demand-Side Cognitive Pole reflects long-term occupancy logic: homebuyers evaluate housing as a lived environment over

an extended time horizon, whereas supply-side actors evaluate the same factors from the perspective of short-term project delivery and cost recovery. The systematic elevation of these factors by homebuyers constitutes the primary source of cognitive gap in this study.

Zone 3: Cognitive Overlap/Consensus Zone.

Analytical Interpretation: Construction Quality (A43, $\Delta = 0.06$) and Building Appearance (A53, $\Delta = 0.26$) occupy the Consensus Zone; both factors showed non-significant ANOVA results (A43: $F = 0.25$, $p = 0.781$; A53: $F = 2.68$, $p = 0.071$). This convergence is analytically significant: it suggests that Construction Quality and esthetic presentation are perceived as shared baseline standards by both supply-side and demand-side stakeholders, likely because quality failures carry reputational and legal consequences for developers while directly affecting homebuyer satisfaction. The Consensus Zone provides a potential entry point for collaborative planning dialog and stakeholder alignment initiatives.

Strategic Implication: The moderate overlap zone represents potential bridging opportunities for collaborative planning and stakeholder alignment. Factors in this zone can serve as common ground for negotiation and consensus-building in participatory planning processes.

Zone 4: Near Demand-Side Pole.

Factors where demand-side ratings exceed supply-side ratings by 0.30–0.49 points, indicating a meaningful but not extreme demand-side preference:

- A51 Spatial Efficiency ($\Delta = 0.47$);
- A52 Functional Layout ($\Delta = 0.43$);
- A65 Community Impact ($\Delta = 0.48$);
- A13 Environmental Quality ($\Delta = 0.31$);
- A22 Price Acceptability ($\Delta = 0.34$).

Analytical Interpretation: Spatial Efficiency (A51, $\Delta = 0.47$), Functional Layout (A52, $\Delta = 0.43$), and Community Impact (A65, $\Delta = 0.48$) fall in the Near Demand-Side Pole, indicating that homebuyers rated these factors meaningfully higher than supply-side stakeholders without reaching the extreme divergence seen in Zone 1. This pattern reflects the daily use and quality-of-life logic of homebuyers, for whom spatial organization and community environment determine residential livability, contrasted with supply-side actors who treat these as secondary design or cost variables. This zone also includes Environmental Quality (A13, $\Delta = 0.31$) and Price Acceptability (A22, $\Delta = 0.34$), which exhibit moderate demand-side preference without reaching the stronger divergence observed in Zone 2.

Zone 5: Emerging Governance Awareness Zone.

Factors where marginal or non-significant ANOVA results and minimal effect sizes ($\eta^2 \leq 0.04$) indicate that stakeholder positions have not yet crystallized into differentiated priorities:

- A63 Social Inclusion ($F = 3.02$, $p = 0.052$, $\eta^2 = 0.034$). Although A63 approached statistical significance at the conventional threshold ($p = 0.052$), the effect size remained very small ($\eta^2 = 0.034$), indicating only weak differentiation among stakeholder groups. This marginal significance with minimal practical effect is precisely why A63 is classified within the Emerging Governance Awareness Zone rather than either cognitive pole: stakeholder positions are beginning to diverge but have not yet crystallized into the strong, consistent patterns observed for other factors. These findings should be treated as preliminary pending replication with larger samples.
- A64 Governance Transparency ($F = 1.80$, $p = 0.168$, $\eta^2 = 0.020$).

Analytical Interpretation: The non-significant ANOVA results for Governance Transparency (A64, $p = 0.168$) and the near-threshold result for Social Inclusion (A63, $p = 0.052$)

indicate that stakeholder positions on these governance dimensions have not yet crystallized into stable, divergent perceptions. This pattern reflects an institutional void: governance transparency lacks established certification or rating systems in Taiwan's low-rise housing sector, leaving all stakeholder groups without a shared evaluative framework. Future research should monitor whether governance perceptions differentiate as ESG disclosure requirements mature. Figure 3 presents the complete SCGF diagram, mapping all 19 planning factors across the five analytical zones according to their effect sizes and direction of stakeholder divergence.

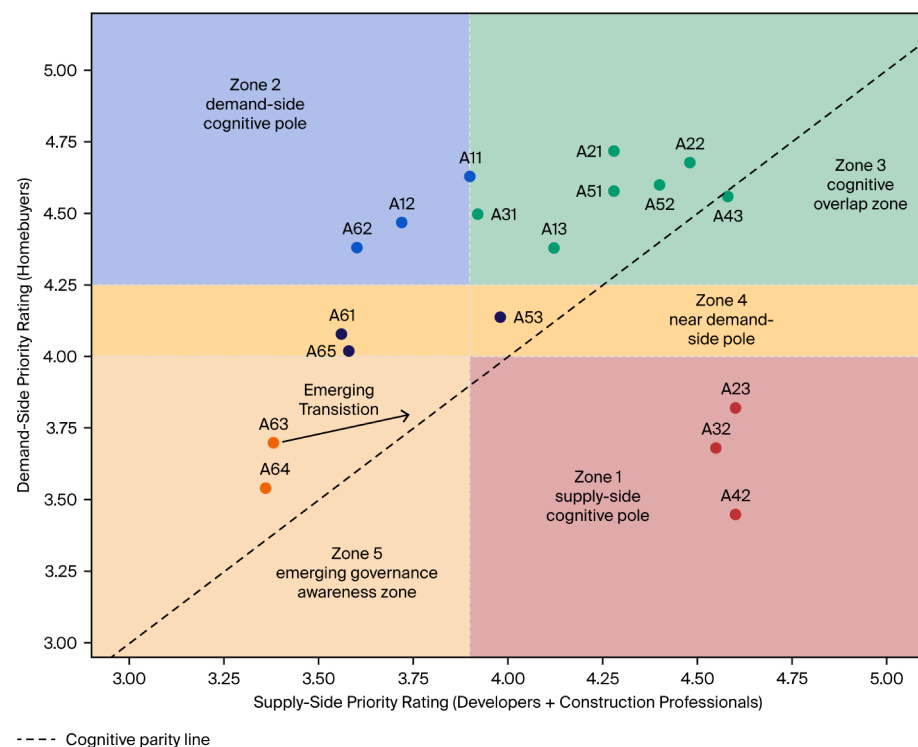


Figure 3. Stakeholder cognitive gap framework (SCGF): a conceptual and diagnostic framework. The background colors represent the five analytical zones of the Stakeholder Cognitive Gap Framework (SCGF). The dashed diagonal line indicates the cognitive parity line ($x = y$), where supply-side and demand-side priority ratings are equal.

Strategic Implication: The governance void zone requires institutional development—regulatory mandates, standardized frameworks, enforcement mechanisms, and stakeholder education—rather than relying on voluntary market-driven adoption. Policy intervention is necessary to elevate these factors from institutional voids to salient planning considerations.

5.5.3. Comparative Evidence and Transferability

The supply–demand cognitive gap pattern observed in Taiwan is consistent with international evidence across diverse housing markets:

Japanese Housing Market: Naoi et al. [37] demonstrated that Japanese homebuyers incorporate earthquake risk into housing valuation, illustrating how risk perception can systematically influence residential decision-making. This pattern parallels the differentiated risk perceptions observed among stakeholder groups in Taiwan. Bal et al. [43] further confirmed that stakeholder engagement in construction sustainability requires structured participation mechanisms to bridge perception gaps between supply- and demand-side actors.

Malaysian Housing Market: Zulkepli and Abdul Rahman [12] found systematic priority mismatches between Malaysian affordable homebuyers (who emphasized envi-

ronmental features and sustainability criteria) and developers (who prioritized financial feasibility and design quality). Talapatra [10] documented strong demand-side sustainability preferences. March and Shapira's risk perception framework [20] helps explain how managerial roles and organizational priorities may shape the relative weighting of non-financial considerations. Yang et al. [27] identified persistent supply-side adoption barriers through evolutionary game analysis.

These cross-national patterns suggest that supply–demand cognitive gaps are structurally embedded in residential development relationships across diverse markets, arising from fundamental divisions in roles, time horizons, and information endowments. The SCGF may offer transferable analytical insights for interpreting similar patterns in comparable non-metropolitan housing contexts, pending future empirical validation. Taiwanese urban regeneration research likewise indicates that redevelopment priorities are shaped not only by market forces but also by government intervention and sociospatial considerations, reinforcing the importance of balancing stakeholder interests in residential planning [44].

5.6. Practical Implications

The findings yield several practical implications for policymakers, developers, and participatory planning processes.

Institutional Voids and Policy Priorities: The governance transparency non-result and marginal social inclusion result identify institutional voids requiring policy intervention. Advancing governance transparency and social inclusion in residential development requires institutional development, encompassing regulatory mandates, standardized metrics, enforcement mechanisms, and stakeholder education, rather than relying on voluntary adoption.

Split Incentive Problem: The energy efficiency perception gap exemplifies the split incentive problem: homebuyers value energy efficiency and are willing to pay premiums, but developers bear upfront costs without capturing long-term operational cost savings. This market failure justifies policy interventions such as mandatory energy efficiency standards, green building incentives, and energy performance disclosure requirements. This phenomenon is consistent with the energy paradox, whereby economically beneficial energy-efficient technologies remain under-adopted because of information asymmetry, split incentives, and market imperfections [33].

Rebound Effects and Behavioral Complexity: The documented rebound effects [41] highlight the complexity of translating green features into actual sustainability outcomes. Policy interventions must account for behavioral responses through complementary measures such as progressive energy pricing, consumption feedback systems, and behavioral nudges.

The following actions are recommended for policymakers:

Address Split Incentives: Implement mandatory energy efficiency standards, green building incentives, and energy performance disclosure requirements to align developer incentives with homebuyer preferences and societal sustainability goals. These policy recommendations are consistent with evolutionary game evidence showing that government incentives and stakeholder interaction are essential to promote sustainable residential transformation [27].

Develop Governance Frameworks: Establish standardized ESG disclosure frameworks, governance transparency requirements, and enforcement mechanisms for residential developers, extending beyond listed companies to small- and medium-sized firms.

Strengthen Social Inclusion: Expand accessibility requirements to small-scale low-rise projects, provide universal design incentives, and develop age-friendly housing standards to address demographic aging.

Facilitate Information Flow and ESG Finance: Implement energy performance labeling, green building certification subsidies, and consumer education programs to reduce information asymmetry. Policymakers should further consider green mortgage incentives and ESG-linked housing finance instruments—such as preferential loan rates for certified green buildings—to align developer incentives with homebuyer sustainability preferences and accelerate the adoption of low-carbon residential standards [45].

These recommendations are aligned with Taiwan's ongoing implementation of the FSC sustainability disclosure roadmap for listed companies [5].

The following actions are recommended for participatory planning:

Leverage Consensus Zone: Focus collaborative planning efforts on factors in the Cognitive Overlap/Consensus Zone (Construction Quality—A43; Building Appearance—A53) where stakeholder interests converge, using these as common ground for dialog.

Bridge Cognitive Gaps: Use structured dialog, information sharing, and joint problem-solving to bridge cognitive gaps between supply- and demand-side stakeholders, fostering mutual understanding of divergent priorities [46].

Elevate Emerging Governance Awareness: Use participatory processes to elevate governance transparency and social inclusion from institutional voids to salient planning considerations, building stakeholder awareness and consensus for institutional development. Participatory planning can also reduce sociospatial inequalities by incorporating diverse stakeholder perspectives throughout the redevelopment process [44].

Achieving net-zero residential development requires coordinated engagement among governments, developers, financial institutions, and end users, consistent with recent systematic reviews of stakeholder roles in net-zero carbon buildings [47].

5.7. Study Limitations

This study has several limitations that suggest directions for future research:

1. **Cross-Sectional Design:** The cross-sectional survey design captures stakeholder perceptions at a single point in time, limiting our ability to track perception changes over time or assess causality. Longitudinal research tracking stakeholder perceptions over multiple years would provide insights into sustainability transition dynamics and institutional development processes.
2. **Single Geographic Context:** This study focuses on Changhua County, Taiwan, limiting the transferability of the findings to other regional contexts.
3. **Stated vs. Revealed Preferences:** The survey measures stated importance ratings rather than revealed preferences through actual behavior. Hedonic pricing studies analyzing actual transaction data would complement stated preference findings and test whether stated sustainability preferences translate into willingness to pay.

6. Conclusions

6.1. Summary of Key Findings

Residential development planning in Taiwan exhibits a systematic stakeholder cognitive gap between supply- and demand-side actors, rooted in structurally different roles, time horizons, and information endowments rather than in idiosyncratic preferences. In this study, we investigated perception differences among developers, homebuyers, and construction professionals regarding 19 planning factors organized into six dimensions, using survey data from 176 respondents in Changhua County, Taiwan.

The empirical analysis revealed significant between-group differences for 15 of 19 planning factors ($p < 0.05$), with effect sizes ranging from small to large ($\eta^2 = 0.020$ to 0.454). Three systematic patterns emerged:

First, supply-side stakeholders (developers and construction professionals) consistently prioritized factors related to cost control (construction cost), risk management (construction difficulty, government regulation), and financing capacity (developer financing capacity). These priorities reflect supply-side actors' focus on project feasibility, operational execution, and liability management, driven by short-to-medium time horizons (1–4 years), direct exposure to financial and regulatory risk, and specialized technical and regulatory knowledge.

Second, demand-side stakeholders (homebuyers) consistently prioritized factors related to location quality (transportation convenience, living amenities), spatial functionality (spatial efficiency, functional layout), and sustainability attributes (green building certification, energy efficiency, community impact). These priorities reflect homebuyers' focus on long-term occupancy value, quality of life, and emerging sustainability preferences, driven by long time horizons (20–30+ years), direct exposure to occupancy quality, and growing sustainability awareness. Third, sustainability-related considerations emerged as a particularly pronounced area of cognitive divergence. Homebuyers rated green building certification, energy efficiency, and community impact significantly higher than supply-side stakeholders, reflecting demand-side leadership in sustainability transition. However, governance transparency showed non-significant differences across all groups ($p = 0.168$), indicating an institutional void where governance awareness has not yet crystallized into a distinct, measurable construct.

Additional robustness analyses using ANCOVA and Tukey's HSD further confirmed that the principal stakeholder differences remained stable after controlling for demographic characteristics and under more conservative post hoc comparisons.

6.2. Conceptual Contributions

This study makes three principal conceptual contributions:

1. **Stakeholder Cognitive Gap Framework:** We propose a Stakeholder Cognitive Gap Framework that identifies five key zones in residential development planning: (1) Supply-Side Cognitive Pole (cost control, risk management, financing capacity), (2) Demand-Side Cognitive Pole (location quality, spatial functionality, sustainability attributes), (3) Cognitive Overlap/Consensus Zone (Construction Quality—A43, $\Delta = 0.06$; Building Appearance—A53, $\Delta = 0.26$), (4) Near Demand-Side Pole (spatial efficiency and functional layout, $0.30 \leq \Delta < 0.50$), and (5) Emerging Governance Awareness Zone (governance transparency and social inclusion—nascent institutional awareness). This framework provides a diagnostic lens for identifying, interpreting, and addressing structural misalignments in residential development planning.
2. **Structural Characteristics as Analytical Lenses:** This study identifies three structural characteristics—role differentiation, time horizon divergence, and information asymmetry—as interpretive lenses for understanding why cognitive gaps emerge between supply- and demand-side stakeholders. These characteristics provide an analytical vocabulary for diagnosing stakeholder misalignments in residential development planning contexts.
3. **Empirical Evidence from a Representative Non-Metropolitan Housing Context:** This study provides systematic empirical evidence of stakeholder cognitive gaps in Changhua County, Taiwan—a non-metropolitan low-rise housing context that is underrepresented in the international literature. The findings offer transferable analytical insights for researchers and practitioners working in similar housing contexts undergoing sustainability transitions, while acknowledging the need for future validation across different geographic and institutional settings.

6.3. Research and Managerial Implications

The Stakeholder Cognitive Gap Framework proposed in this study provides a diagnostic lens for identifying, interpreting, and addressing structural misalignments in residential development planning, with implications extending beyond Taiwan to comparable non-metropolitan Asian housing markets undergoing sustainability transitions.

Regarding policymakers, the findings justify policy interventions to address split incentives (mandatory energy efficiency standards, green building incentives), develop governance frameworks (ESG disclosure requirements for small and medium-sized developers), strengthen social inclusion (expanded accessibility requirements, universal design incentives), and facilitate information flow (energy performance labeling, consumer education).

Regarding developers, the findings highlight the importance of aligning project planning with demand-side priorities (location quality, spatial functionality, sustainability attributes), investing in sustainability features that homebuyers value, enhancing governance transparency to build trust, and communicating lifecycle value propositions to justify sustainability premiums.

Regarding participatory planning, the findings suggest leveraging moderate overlap zones (construction quality, building appearance) as common ground for stakeholder collaboration, using structured dialog to bridge cognitive gaps, and elevating governance voids (governance transparency, social inclusion) through participatory processes that build stakeholder awareness and consensus.

6.4. Contributions to the Sustainable Housing Literature

This study contributes to the growing international literature on residential development planning and stakeholder perceptions in sustainable housing [9,10,23] as follows:

- It provides systematic empirical evidence of supply-demand cognitive gaps in a non-metropolitan Asian housing market undergoing sustainability transition.
- It demonstrates that sustainability-related considerations (green building, energy efficiency, community impact) constitute a distinct planning dimension that is systematically undervalued by supply-side stakeholders relative to demand-side stakeholders [28].
- It identifies governance transparency as an institutional void requiring policy intervention, extending Taiwan's building technical regulations [9] and international evidence on uneven ESG integration to Taiwan's residential development context.
- It confirms demand-side leadership in sustainability transition, consistent with recent evidence from Malaysia [12], Costa Rica [13], and India [10].
- It presents a Stakeholder Cognitive Gap Framework that provides transferable analytical insights for comparable housing markets undergoing sustainability transitions, pending future empirical validation.

6.5. Limitations

This study has several limitations. First, the cross-sectional design limits ability to track perception changes over time. Second, the geographic scope is restricted to Changhua County, limiting the transferability of the findings to other regional contexts.

Third, this study measures stated preferences rather than revealed preferences through actual market behavior. Hedonic pricing analyses and transaction data would provide complementary evidence on whether the stated sustainability preferences translate into measurable market premiums.

Fourth, this study relies on stated importance ratings from a structured questionnaire, which may not fully capture the complexity of stakeholder decision-making processes.

Qualitative methods such as in-depth interviews or focus groups could provide richer insights into the cognitive mechanisms underlying the observed perception gaps.

Fifth, unequal sample sizes across stakeholder groups (developers $n = 37$, homebuyers $n = 92$, construction professionals $n = 47$) reflect actual population proportions rather than a design flaw, but future research with larger balanced samples would strengthen the statistical power of the analysis.

Sixth, A3 (Capital Capacity) was not treated as a single composite construct because A31 and A32 represent structurally distinct financing perspectives; no composite α is reported. A2 (Housing Price) was conceptualized as a formative planning domain comprising conceptually distinct planning considerations rather than a reflective latent construct. Consequently, lower internal consistency was considered theoretically expected rather than indicative of measurement deficiency. Future studies may further decompose this planning domain into separate demand- and supply-side constructs or formally model it using formative measurement approaches.

Finally, this study measures stakeholder perceptions but does not link them to measured sustainability outcomes, suggesting a priority direction for future empirical work.

6.6. Future Research Directions

Future research should pursue several directions:

Longitudinal Studies: Track stakeholder perceptions over time to examine sustainability transition dynamics, institutional development processes, and generational shifts in preferences.

Comparative Analysis: Conduct cross-regional and cross-national comparative studies to test the transferability of findings.

Revealed Preference Studies: Use hedonic pricing analysis and transaction data to test whether stated sustainability preferences translate into willingness to pay and market premiums.

Expanded Stakeholder Analysis: Include government regulators, financial institutions, real estate agents, and community organizations to provide a more comprehensive understanding of cognitive gaps across the full development ecosystem.

Sustainability Outcome Measurement: Link stakeholder perceptions to measured sustainability outcomes (energy consumption, carbon emissions, accessibility performance) to test whether perception gaps translate into performance gaps.

Institutional Development Research: Examine policy development, regulatory evolution, and stakeholder learning processes that drive institutional transitions from governance voids to salient planning considerations.

Behavioral Interventions: Test policy interventions (information disclosure, incentive design, behavioral nudges) aimed at bridging cognitive gaps and aligning supply-side incentives with demand-side preferences.

Construct Decomposition: Future studies may further decompose the housing price planning domain into separate demand- and supply-side constructs or formally model it using formative measurement approaches. We therefore interpret A2 as a formative planning domain rather than a reflective latent construct.

6.7. Closing Statement

This study demonstrates that stakeholder cognitive gaps in residential development planning are systematic, substantial, and rooted in structural differences between supply- and demand-side actors. The SCGF provides a conceptual and diagnostic perspective for interpreting and addressing these misalignments, with potential relevance to sustainability transitions in comparable non-metropolitan housing markets pending future validation. As

Taiwan and comparable markets pursue net-zero emissions pathways and ESG integration, understanding and bridging stakeholder cognitive gaps will be essential for aligning residential development practice with societal sustainability goals. The findings suggest that sustainability transition in Taiwan's low-rise housing market is constrained not by technological limitations but by persistent stakeholder cognitive misalignment.

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Informed Consent Statement: Participation was voluntary and informed consent was obtained from all participants prior to data collection. All respondents were clearly informed of the study's purpose, the voluntary nature of participation, and their right to withdraw at any time without consequence.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Rietdijk, C.E. Affordability of Social Housing for Youth in Greater Taipei: Justice for Whom? *Int. J. Hous. Policy* **2023**, *23*, 804–816. [CrossRef]
2. Juan, Y.-K.; Hsing, N.-P.; Hsu, Y.-H. Applying the Kano Two-Dimensional Model and Quality Function Deployment to Develop Sustainable Planning Strategies for Public Housing in Taiwan. *J. Hous. Built Environ.* **2019**, *34*, 265–282. [CrossRef]
3. Ministry of the Interior, Taiwan. *Statistical Yearbook of Interior 2024*; Chapter 10: National Land Management; Ministry of the Interior: Taipei, Taiwan, 2024. Available online: <https://statis.moi.gov.tw/micst/webMain.aspx?k=menuy> (accessed on 11 June 2026).
4. Changhua County Government. *Statistical Yearbook of Changhua County 2020*; Changhua County Government: Changhua, Taiwan, 2020. Available online: [https://ctrl.chcg.gov.tw/files/20211006140301847_109%E5%B9%B4%E5%BD%B0%E5%8C%96%E7%B8%A3%E6%94%BF%E5%BA%9C%E7%B5%B1%E8%A8%88%E5%B9%B4%E5%A0%B1\(%E7%BE%A4%E5%BD%A9\)_2025.pdf](https://ctrl.chcg.gov.tw/files/20211006140301847_109%E5%B9%B4%E5%BD%B0%E5%8C%96%E7%B8%A3%E6%94%BF%E5%BA%9C%E7%B5%B1%E8%A8%88%E5%B9%B4%E5%A0%B1(%E7%BE%A4%E5%BD%A9)_2025.pdf) (accessed on 11 June 2026).
5. Financial Supervisory Commission (FSC), Taiwan. *Roadmap for Taiwan Listed Companies to Align with IFRS Sustainability Disclosure Standards*; FSC: Taipei, Taiwan, 2023; Financial Supervisory Commission (FSC) Roadmap Announcement. Available online: https://www.fsc.gov.tw/en/home.jsp?dataserno=202308180001&dtable=News&id=54&mcustomize=multimessage_view.jsp&parentpath=0,2 (accessed on 11 June 2026).
6. Wolf, I.; Kratzer, J.; Reimer, C. Stakeholder Perspectives on Policy, Social, and Organizational Challenges of Sustainable Residential Multi-Storey Building Retrofitting in Germany. *Buildings* **2025**, *15*, 3566. [CrossRef]
7. Sukereman, A.S.; Isa, M.; Abd Talif, K.A.; Zainol, N.N.; Yunus, N.M. Challenges in Sustainable Residential Property Development in Shah Alam: Pathways towards Implementing Sustainable Development Goals (SDGs). *Int. J. Prop. Sci.* **2024**, *14*, 16–36. [CrossRef]
8. Chuweni, N.N.; Mohamed Saraf, M.H.; Fauzi, N.S.; Md Wadzir, M.F. What Motivates the Malaysian Homebuyers to Go Green? *Plan. Malays. J.* **2023**, *21*, 252–263. [CrossRef]
9. Ministry of the Interior, Taiwan. Building Technical Regulations—Design and Construction Section. Laws and Regulations Database of Taiwan. Available online: <https://law.moj.gov.tw/LawClass/LawAll.aspx?pcode=D0070115> (accessed on 11 June 2026).
10. Talapatra, J. Demand Side Perspective on Sustainable Housing. In *Sustainable Housing in India*; Routledge: London, UK, 2026; pp. 45–68. [CrossRef]

11. Mottaeva, A.; Epkhiev, O.; Moiseev, A. Factors of the “Green” Construction Development from the Point of View of Different Stakeholders. *E3S Web Conf.* **2023**, *402*, 07031. [CrossRef]
12. Zulkepli, M.; Abdul Rahman, M.S. Balancing Affordability and Sustainability: Unveiling Homebuyers’ Preferences for Green Affordable Housing Criteria and Features. *Plan. Malays. J.* **2025**, *23*, 1–19. [CrossRef]
13. Okot, T. Bridging Sustainability Awareness and Housing Preferences: Insights from Generation Z in Costa Rica. *Sci. Rev. Eng. Environ. Sci.* **2025**, *34*, 362–375. [CrossRef]
14. Akerlof, G.A. The Market for “Lemons”: Quality Uncertainty and the Market Mechanism. *Q. J. Econ.* **1970**, *84*, 488–500. [CrossRef]
15. Freeman, R.E. *Strategic Management: A Stakeholder Approach*; Pitman: Boston, MA, USA, 1984.
16. Weick, K.E. *Sensemaking in Organizations*; Sage Publications: Thousand Oaks, CA, USA, 1995.
17. Flanagan, R.; Norman, G. *Risk Management and Construction*; Blackwell Science: Oxford, UK, 1993.
18. Chapman, R.J. The Controlling Influences on Effective Risk Identification and Assessment for Construction Design Management. *Int. J. Proj. Manag.* **2001**, *19*, 147–160. [CrossRef]
19. Zou, P.X.W.; Zhang, G.; Wang, J. Understanding the Key Risks in Construction Projects in China. *Int. J. Proj. Manag.* **2007**, *25*, 601–614. [CrossRef]
20. March, J.G.; Shapira, Z. Managerial Perspectives on Risk and Risk Taking. *Manag. Sci.* **1987**, *33*, 1404–1418. [CrossRef]
21. Miller, K.D. A Framework for Integrated Risk Management in International Business. *J. Int. Bus. Stud.* **1992**, *23*, 311–331. [CrossRef]
22. Mohamad Tarmizi, M.N.; Mohd Noor, S.N.A.; Ramly, M.K.A.; Naamandadin, N.A. Unlocking the Ideal Home: Exploring User Preferences and Sustainable Green Residential House Features for Smart Buyers. *Malays. J. Sustain. Environ.* **2023**, *10*, 255–272.
23. Juan, S.-I.; Tsaih, L.S.-J. Exploring Views on Design and Service Factors for Improving Housing Development Green Space Quality in Taiwan. *J. Asian Archit. Build. Eng.* **2022**, *21*, 1926–1941. [CrossRef]
24. Glaeser, E.L.; Kahn, M.E. Sprawl and Urban Growth. In *Handbook of Regional and Urban Economics*; Henderson, J.V., Thisse, J.F., Eds.; Elsevier: Amsterdam, The Netherlands, 2004; Volume 4, pp. 2481–2527. [CrossRef]
25. Sirmans, G.S.; Macpherson, D.A.; Zietz, E.N. The Composition of Hedonic Pricing Models. *J. Real Estate Lit.* **2005**, *13*, 3–43. [CrossRef]
26. Architecture and Building Research Institute (ABRI), Ministry of the Interior, Taiwan. Taiwan Green Building Evaluation System (EEWH). Available online: <https://smartgreen.abri.gov.tw/default.aspx> (accessed on 11 June 2026).
27. Yang, Y.; Sun, R.; Dai, J.; Zhu, M. Evolutionary Analysis of Stakeholder Behavior in Green Retrofitting of Traditional Residential Buildings Based on Dissemination and Game Models. *PLoS ONE* **2023**, *18*, e0282314. [CrossRef] [PubMed]
28. Xu, H.; Zhang, J.; Xu, X.; Zeng, Z.; Xu, Y.; You, J.; Li, J. Simulation Modelling for the Promotion of Green Residence Based on the Theory of Sustainability—Taking Jiangsu Province as an Example. *Buildings* **2023**, *13*, 2635. [CrossRef]
29. National Development Council (NDC), Taiwan. *Population Projections for the R.O.C. (Taiwan): 2024–2070*; National Development Council: Taipei, Taiwan, 2024. Available online: https://pop-proj.ndc.gov.tw/main_en/News_Content.aspx?n=139&s=155&sms=10334 (accessed on 11 June 2026).
30. Construction and Planning Agency, Ministry of the Interior, Taiwan. *Design Specifications of Accessible and Usable Buildings and Facilities*; Ministry of the Interior: Taipei, Taiwan, 2019. Available online: <https://glrs.moi.gov.tw/LawContent.aspx?id=GL000734> (accessed on 11 June 2026).
31. Ennin, A.A.; Ayarkwa, J.; Osei-Asibey, D.; Amoah, P.; Baah, B.; Atanga, R. Framework for Integrating Energy-Efficient Mortgage into Environmentally Sustainable Housing. *Energy Build.* **2025**, *336*, 116504. [CrossRef]
32. Chiu, C. Negotiating Urban Greening Through Housing Development: Stakeholders and Sociospatial Strategies in a Municipality-Led Eco-Building Programme. *Hous. Theory Soc.* **2024**, *41*, 169–191. [CrossRef]
33. Jaffe, A.B.; Stavins, R.N. The Energy Paradox and the Diffusion of Conservation Technology. *Resour. Energy Econ.* **1994**, *16*, 91–122. [CrossRef]
34. Georgiadou, M.C.; Ionica, M.L. ESG Integration in Residential Real Estate: The Case of Constanța, Romania. *Sustainability* **2025**, *17*, 7701. [CrossRef]
35. Kim, M. The Early Case for Stabilization and Sustainability of Korean G-SEED Based on Collaborative Governance: A Theoretical Review. *Buildings* **2023**, *13*, 2631. [CrossRef]
36. Abuzaid, H.; Almashhour, R.; Mohammed, A.; Beheiry, S. Assessment of the Perception of Sustainability for Occupants of Residential Buildings: A Case Study in the UAE. *Buildings* **2022**, *12*, 994. [CrossRef]
37. Naoi, M.; Sumita, K.; Seko, M. Estimating Consumer Valuation of Earthquake Risk: Evidence from Japanese Housing Markets. *Int. Real Estate Rev.* **2010**, *13*, 117–133.
38. Ministry of the Interior, Taiwan. *Housing Price-to-Income Ratio Statistics 2024*; Ministry of the Interior: Taipei, Taiwan, 2024. Available online: <https://pip.moi.gov.tw/V3/E/SCRE0401.aspx> (accessed on 12 June 2026).
39. Tseng, C.-C.; Huang, L.-S.; Huang, C.-F. A Study on the Spatial Layout of Newly Built Townhouses in Kaohsiung City. *Appl. Sci.* **2024**, *14*, 8547. [CrossRef]

40. Chan, A.P.C.; Darko, A.; Ameyaw, E.E. Strategies for Promoting Green Building Technologies Adoption in the Construction Industry—An International Study. *Sustainability* **2017**, *9*, 969. [CrossRef]
41. Olson, E.L. Rebound Effects as an Obstacle to Sustainable Housing Goals: How Green Features Lead to Larger-Sized Homes. *Sustain. Dev.* **2025**, *33*, 3879–3887. [CrossRef]
42. DiPasquale, D.; Wheaton, W.C. *Urban Economics and Real Estate Markets*; Prentice Hall: Englewood Cliffs, NJ, USA, 1996.
43. Bal, M.; Bryde, D.; Fearon, D.; Ochieng, E. Stakeholder Engagement: Achieving Sustainability in the Construction Sector. *Sustainability* **2013**, *5*, 695–710. [CrossRef]
44. Lan, C.I.-C.; Lee, C.-J. Property-Led Renewal, State-Induced Rent Gap, and the Sociospatial Unevenness of Sustainable Regeneration in Taipei. *Hous. Stud.* **2021**, *36*, 843–866. [CrossRef]
45. Central Bank of the Republic of China (Taiwan). *Annual Report 2024*; Central Bank of the Republic of China (Taiwan): Taipei, Taiwan, 2024. Available online: <https://www.cbc.gov.tw/en/cp-649-162887-6A145-2.html> (accessed on 12 June 2026).
46. Olander, S.; Landin, A. Evaluation of Stakeholder Influence in the Implementation of Construction Projects. *Int. J. Proj. Manag.* **2005**, *23*, 321–328. [CrossRef]
47. Falana, J.; Osei-Kyei, R.; Tam, V.W.Y. A Systematic Review of Stakeholder’s Interest towards Achieving Net Zero Carbon Building. *Int. J. Build. Pathol. Adapt.* **2026**, *44*, 163–184. [CrossRef]

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