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HOUSING PREFERENCE STRUCTURES IN EAST ASIA: AN EMPIRICAL STUDY AND NON-PARADIGMATIC SHIFTS BETWEEN NEARBY METROPOLES

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Abstract. A systematic research flow was applied to the Southern Metropolis in Taiwan not only to recount residents' considerations in this cultural area but also to compare them with those of other metropolitans on the island in relation to general housing concerns. The constructs and factors in housing decision-making were justified using the literature, confirmed with experts in the field, and organised as a decision hierarchy that formed the foundation of a survey. The investigation combined the analytic hierarchy process and Student's *t*-test, both of which are credible methods, to facilitate a grounded process for mind mining. The importance of constructs/factors were thus assessed on a numerical basis, and a set of unforeseen insights were explored for the different parties of interest (e.g., buyers, construction companies, agents, asset managers, etc.). Opinion gaps between different sample groups were identified. This set of empirical knowledge filled the gap in the literature. It is noteworthy that among the constructs in the region studied, (housing) 'conditions' dominated 'price', while 'location and transport' was the least important. A 'non-paradigmatic shift' in people's total housing preference structure, which changed gradually with decreasing population density and increasing plain geography from the north to the south between nearby metropoles, was observed, despite the niche but commensurable cultural norm in East Asia being the overall scenario of the island. Some existing claims about the housing preferences in this area were also either supported or rebutted by the quantitative evidence(s).

Keywords: inhabitants and housing, decision making, preference structure, empirical survey, constructs and factors, East Asia.

Introduction

Housing is a basic (human) right which everyone is entitled to (Sidoti, 1997), but not all are able to enjoy (Rajagopal, 2020). The activity of housing is characterized by 'a set of attributes and functions that are valued differently', in which the consumption (decision) of 'good housing' is made considering the preferences of their attributes, perceived tangibly/intangibly by the consumers (Marques et al., 2020; Batista & Marques, 2021). Therefore, housing preferences can be defined as the elements that affect decisions made for housing (e.g., purchase or rental).

Understanding people's (users') general housing preference structure, including their quantifiable preferences rendered on those tangible/intangible attributes included by this structure, is thus not only a valuable work for the A/E/C (architect, engineering and construction) industry or real-estate agents to well manage their (potential) consumers, but also an interesting topic for the market or academic researchers. Among the studies being conducted on housing preference, a key series of studies are mainly related to (the set of) the factors or attributes determining people's housing decisions (behaviours).

Although a number of topics on housing (or relevant) behaviours and a diversified range of factors have been scrutinised for certain groups of people, there is still a lack of systematic review and/or study of East Asian people's perceptions of the preference structure and housing factors. Moreover, our reading of previous studies suggests that demographical differences in housing preference

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between nearby cities or metropoles (e.g., when population densities differ considerably) are rarely addressed in the literature (see in the later literature study section). However, in the region studied, despite it has been evident that there are subtle differences in the housing context between Tokyo and Shanghai, the cultural patterns in housing preferences share a rather homogeneous basis (Izuhara, 2010). This was a key assumption in this study.

This study aims to fill this gap by including and comparing factors influencing housing preferences in different nearby cities, based on the abovementioned assumption, using Taiwan as the investigated area. Through several combined research phases, this research concluded (through rigorous confirmations from empirical data) that 'price' and 'conditions' were two important housing constructs in the two southern municipalities, or the 'Southern Metropolis', on this island. Through some comparisons, the differences in such a niche preference structure for housing against those of people in northern or middle metropoles in Taiwan are identified and demonstrated. Two types of further analysis, with their different analytical aims in the intrinsic, are also supplied. See Section 1 that will follow immediately.

The findings from the above works may provide evidence for housing decision-making of people from this sparsely populated (also plain terrain) area, in contrast to those of people in the northern or middle metropoles in Taiwan. This may not only draw significant implications for several domains such as agents or brokers, but also help construction companies' selection process for land resource(s) at the beginning of a project and subsequent marketing actions. It also affects the asset management decision-making of parties of interest.

We refer to Section 1 for the research phases. Section 2 reviews the relevant literature. Section 3 introduces the key methods used by this study in more detail. Section 4 distils the main results from the survey and identifies those salient opinion gaps between sample groups. Section 5 provides a summary and discusses the implications. Last section concludes the study.

1. Research resign

The following steps were designed and followed to accomplish the research:

1. A deep literature study. First of all, this research reviewed studies that addressed local housing factors differentiated between the preferences for 'the main critical factors' of people currently living in the Southern Metropolis' and those of people living in other more densely populated cities. Surprisingly, in this area, 'price' and 'conditions' were two important housing constructs, whereas location and transport concerns could be merged into one construct – 'location and transport' (or simply 'location'; see the literature review). As each construct included several factors (criteria), we selected these factors with input also from a number of senior real estate agents using face-to-face consultations (Chi et al., 2019; Fu et al., 2021; Yazdi et al., 2022).
2. The establishment of a suitable 'decision hierarchy' weaving the summarised constructs and factors (which is further confirmed by the field experts). A suite of questionnaires was designed using this hierarchy. It had a '(respondent) profile' questionnaire block (Wu et al., 2018) (or simply 'block' later) to partition the entire sample (e.g., respondents from the city centre, city residential areas, suburbs, or even the countryside of the Southern Metropolis can be partitioned and then opinions raised between different sample groups can be compared). Since a potential buyer surveyed would be a decision-maker (DM) for housing, this followed the sample-stratification concept used in many social science studies (Trost, 1986; Imbens & Lancaster, 1996).
3. A thorough survey polling the opinions toward the constructs and factors for housing in this area using a suite of questionnaires. A suite of questionnaires was designed, and respondents were then polled to understand their opinions of the constructs and factors (with respect to [or the formal abbreviation 'w.r.t' used in decision science or mathematics, hereinafter] a construct) based on the pairwise comparison approach (PCA).
4. Decision-analysis works using AHP to assess the relative importance of the constructs and factors. The results confirmed the supposition that the 'conditions' and 'price' of an estate are the two most critical constructs in this sparsely populated metropolis. In addition, despite being merged into one single construct, the 'location and transport' construct still carried less weight than 'conditions' and 'price'. The difference in this preference structure against those of people in northern or middle metropoles in Taiwan is demonstrated.
5. A further analysis to rank and show the absolute importance of those individual housing factors with discussions given to see whether the results may support or refute the common perceptions of the importance of the factors in people's mind.
6. Another interesting topic as to whether the different sample groups held different opinions of the same subject of preference structure (i.e., 'the same subject' in brief hereinafter) was also analysed further. As the entire sample was partitioned using different stratification rules (see point 2), the independent-samples *t*-test was applied to analyse this matter (i.e., the statistically significance of a between-group difference).

As such, the results of this study may contribute empirical knowledge to the practice of several involved parties, although the hybridisation of the methods used is also novel. This outcome aligns with the recent concept of providing a tool to support data-driven decision-making

(DDDM, or D^3M) (Marr, 2016) in the field of big data (McAfee et al., 2012). Note that the value of the knowledge explored using the above steps strongly depends on the AHP method's credible measures and scales to accurately probe the potential housing DM's perceptions, i.e. the real preference structure. This is reviewed in Section 3.

The purpose of this section is to clarify the background of this study and to organise a suitable framework of housing factors for investigation.

2. Literature

2.1. Preference(s) and the situation in East Asia

Adequate (affordable) housing has been addressed as a topic in the past decade because house prices have stayed high in almost all areas around the world (UN-Habitat, 2014; United Nations Economic Commission for Europe, 2015; Wulff, 2008). This issue becomes more critical under inflation and the COVID-19 pandemic (Abastante et al., 2020; Quaglio et al., 2021), while governmental efforts or discourses are largely focused on improvement measures (Commissioner for Human Rights, 2020; Mackie, 2015; Olanrewaju & Idrus, 2019; UN-Habitat, 2021; Wang & Murie, 2011). However, another main stream of study is related to housing preference.

For example, Meier et al. (2011) investigated how personal metaphors might affect housing preference. Some studies have addressed how the mental status (i.e., healthy, disordered, etc.) of people (Tanzman, 1993; Richter & Hoffmann, 2017), in addition to their objective characteristics (Yi & Lee, 2014), may lead to different housing preferences. A number of focus groups or special factors have been investigated, e.g., first-time buyers (Khan et al., 2017), self- or functional congruity to explain housing preference (Sirgy et al., 2005), home-ownership and detached-dwelling factors (Wulff, 2008), persons with disabilities (Chenwi, 2021), middle-class families' or young people's locational preferences in urban areas (Karsten, 2007; Leh et al., 2017), young people's environmental preferences in a large metropolis (Wu, 2010), collective housing and supported housing (Verhetsel et al., 2017; Rog, 2004).

Other studies have identified the influence of people's housing preferences on other matters. For example, Bowes et al. (1997) studied the trade-offs between different houses, areas or tenures. Jun (2013) empirically traced the effects of housing preference on selection of residential location. However, few studies have assessed the factors in detail and compared people's preferences (i.e., the preference structure) that influence housing decisions based on the results, although diverse related topics have been addressed for different spatial locations.

Such a situation also holds true for studies conducted specifically in East Asia. An Eastern proverb states: 'when there is land (estate), there is wealth (fortune)'. Lee (2003) studied the 'building blocks' that affect the eventual composition of housing systems, and compared the different situations in Hong Kong, South Korea, Singapore and Taiwan to identify the relative importance of these blocks in shaping the 'housing culture' of East Asian economies, in contrast to Western industrial economies. However, the discussion of 'housing culture' should not be limited to these building blocks of a housing system; rather, people's perception of the factors determining housing decisions should also be investigated. Aulia and Chrisen (2020) studied the habitant (housing) preferences of a niche housing consumer group, i.e., residents of 'gated communities', in East Asia. Rahadi et al. (2015) identified the factors that affect the housing price in Indonesia, and later studied (Rahadi et al., 2021) the millennial generation's housing preferences during the COVID-19 pandemic. McDonald's (2008) social study concluded that high housing costs is a factor for the low fertility (birth rate) in East Asia. Yuhaniz and Jusan (2016) studied the design preferences for houses of Malay homemakers.

The study by Izuhara (2010) showed that the family-based social structure in large cities (i.e., Tokyo and Shanghai) strongly affects cultural norms in East Asian societies, and, therefore, 'family reciprocity' becomes a key driving factor in housing decision-making. It empirically resolved a long debate on whether or not East Asia has a characteristic welfare model and asserted that people in this area demonstrate niche preferential patterns in making housing decisions just because of this special welfare model, subject to a commensurable basis.

In countries with Western cultures, a common saying in the domain of real estate is 'location, location, location'. This rule not only holds for valuing real estate in the United States (Trump, 2015) but has also become the main topic discussed for two decades on a famous TV program in the United Kingdom (IWC Media, 2021). However, as such a statement is sometimes exaggerated or even 'monotonous', scholars worldwide systematically summarised the academic topics a decade ago (Jansen et al., 2011).

Regarding the studied area specifically, many market researchers and reporters have claimed that the dominant factors for housing in northern Taiwan are location, transportation, and living functions; otherwise, the salespeople in that area will not use these as the criteria to evaluate the price of their building cases or estates. The leading editorial articles have generalised this set of factors 'as is' and 'of course' to evaluate the estates everywhere on this island (MyHousing, 2020; LeJu, 2019; FBS Real Estate King, 2020; HouseFun News, 2020). However, this could be considered too 'monotonous' to reflect the real situation in other areas, e.g., in the studied Southern Metropolis in Taiwan (see 2.2).

2.2. Organising the hierarchy of housing factors for investigation

The review is mainly focused on the general housing factors in the studied area, previous research in southern Taiwan as a comparison for those in northern Taiwan, and the literature addressing (and supporting) the constructs/factors that are the hierarchy nodes.

Chen (2020b) explored preference rankings for house transfer inspection in northern Taiwan using the AHP. Teng (2012) conducted an exploratory study of the decision-making process for housing purchase, and the 'critical decision points' were established. Yang (2009) provided a cause and effect analysis for real estate value after a new MRT line was provisioned in Taipei. Pan (2011) also analysed the factors of house-purchasing decisions, specifically in New Taipei City. All these studies agreed with the claim that location, transportation, and living functions are the main concerns during housing purchases. For example, Pan's study concluded that distance to the workplace (location); avoidance of non-preferred operations/facilities, such as gambling/recreation centres/rooms, funeral services, etc. (location), shopping function (living); public transport accessibility, specifically (transportation); and avoidance of carcinogenic facilities, such as electric towers, electricity substations, and nuclear power plants (location) are the main concerns in the area of focus. Therefore, the primary constructs included location, transportation, and living functions factors.

At this point, we review the relevant housing considerations in 'middle Taiwan'. Lai (2007) assessed the main housing constructs from the viewpoint of consumers and summarised that prioritised living environment, living functions, transaction price, quality guarantee, reputation of the building project or construction company were the most critical factors. The last two factors, quality guarantee and reputation, are reasonable because of the '921 Great Earthquake', the most severe earthquake after World War II in Taiwan (History.com Editors, 2018), which caused 51,711 buildings to fully collapsed and 53,768 buildings to partially collapse, most of which were in middle Taiwan because this was the location of the epicentre.

However, living environment (a factor of location) and living functions were addressed, and these are reflective of two-thirds of the main constructs in northern Taiwan. In addition, it is surprising that price was the third important factor. As will be shown later, this is reflective of the situation in southern Taiwan. Moreover, transportation was not a main factor that was considered. This is also reflexive to the situation in southern Taiwan (i.e. it is also deemed unimportant). These observations can be cross-validated with other relevant studies which have also been conducted in middle Taiwan (Chen, 2014; Lin, 2003).

Previous studies have also examined the area of focus of southern Taiwan. Ho (2009) studied the housing preferences of middle-class buyers in Kaohsiung according to their sample stratification and pointed out that the 'economic reason' (i.e. pricing) was a factor for potential buyers. Hsiang (2015) studied the factors affecting house purchasing in Kaohsiung and identified the relationship between family income and the level of durable unit price that the family could afford (i.e., pricing) as an important factor. The study also highlighted factors such as 'feng-shui', 'comfort', and 'living quality' (i.e., condition) as critical considerations. Huang (2016) identified the relationship between green parks and house price as primary factors. Ho's study (2016) addressed the influence of the construction of the city library (a 'location' factor) on house purchase intention. On the basis of the abovementioned studies, Chen and Yu (2019) further confirmed the key roles of the 'feng-shui' and 'public construction' factors (condition and location factors) for the intention to purchase real estate in southern Taiwan. Therefore, price, condition, and location are the three main constructs for housing decision making. These are also supported by studies conducted in cities nearby Kaohsiung.

Chang (2000) analysed the critical success factors (CSF) in Tainan and linked house price with personal utility. Hung (2003) argued that in Ping-Tung, living condition and price-relevant factors (including taxes, i.e. price) are important for consumers' 'purchasing-house consideration'. Additionally, as the transport convenience factor was only addressed briefly in these articles in overall, such as in Hsiang (2015), and transport facilities usually depend on location in southern Taiwan, this factor is included in the 'location' construct in the present study.

Extensive literature was reviewed to support the selection of price, condition, and location as the three main constructs in this study. Regarding price, along with Hung's (2003) argument that price-relevant factors (including tax) are important in the housing market in southern Taiwan, Lin and Shieh's publication made this argument earlier (Lin & Shieh, 2000). Regarding conditions, Qiu (2016) argued that building materials are important for attracting house buyers. This is a key supplement because, as discussed previously, studies rarely address 'physical factors' in addition to 'atmospheric factors'. Finally, regarding location, we supply two additional extensive reports, one summarised by the market news media (Hsieh, 2015a) and another published by the government (Hsieh, 2015b). These two reports addressed the company-side marketing strategies and the user-side location selection logic, respectively, when the housing market is declining.

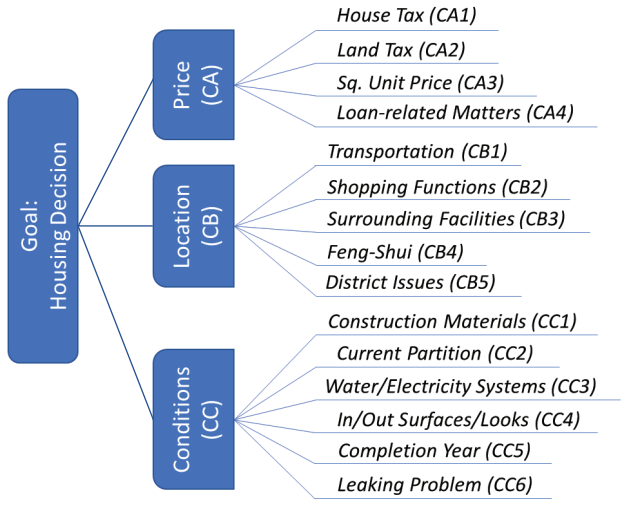

Figure 1. The AHP hierarchy

These location concerns are currently relevant during the 'downturn' due to the COVID-19 pandemic.

From this long review, none of the existing articles, theses, papers, and reports had focused on the main topic of this study. Except for these, many other studies addressing the investment and finance aspects of housing are outside of the scope of this paper (Baum & Hartzell, 2020; Bispinck, 2012; French, 2001). Figure 1 summarises the proposed goal–construct–factor hierarchy for study according to the literature.

In this subsection, we briefly review the methods we applied in our analysis: the AHP and Student's *t*-test. Both are credible methods which have been widely applied in the decision sciences and statistics domain.

3. Methods/methodology

3.1. The Analytic Hierarchy Process (AHP)

This study used the most widely employed (and credible) multi-criteria decision-making (MCDM, or multi-attribute decision-making [MADM]) model, AHP, as the main multi-criteria decision analysis (MCDA) method. In the field of MCDM (defined more generally to include multi-objective decision-making [MODM]), incorporation of the fuzzy concept to address uncertainty (Chutia, 2021; Jiang & Hu, 2021; Muneeb et al., 2021; Rahman, 2022; Tavana et al., 2021; Wang et al., 2021; Xue et al., 2021), novel interdisciplinary applications of existing models (Garg & Rani, 2022; Majumder et al., 2021; Mishra et al., 2021; Turgut & Erdogan, 2020; Zhuang & Yu, 2021), and model refinements (Gong & Fan, 2021; Jin et al., 2021; Khan et al., 2022; Ni et al., 2022; Rahman et al., 2021) are the most popular topics to date. The research context of this study falls within the scope of the second topic.

Using MADM methods to study the various housing topics is not a news. For example, Jansen et al. (2011) summarised measures and analytical methods, such as traditional demand analysis, for various research purposes. They also touched on the purchase-decision topic and proposed applying the MAUT (multi-attribute utility theory, another model for [MCDA]) for a 'suitable choice between alternative places of residence'. However, the applications of MCDA methods are still rather limited, e.g., Wu (2010) used AHP to study environmental housing preferences of a group of young people in a specific city.

Most notably, in the decades since the AHP was proposed by Saaty (1977), this method has been the most widely applied method in the field of MADM (Kahraman et al., 2015) because of multiple empirical verifications of the application. For example, some recent applications and methodological developments (but not limited to these) can ground its application in this study, i.e., Bian et al. (2017), Darko et al. (2019), Dong and Cooper (2016), Dweiri et al. (2016), Erdogan et al. (2017), Han et al. (2020), Hillerman et al. (2017), Karaman and Akman (2018), Nikou and Mezei (2013), and Samuel et al. (2017), and several of these are related to their applications in the economic aspect of civil engineering and construction management.

The AHP is a scientific method for 'mind mining' to understand what a DM is thinking about a decision (Zhuang et al., 2019). Its quantitative results indicate the 'relative importance' of the 'items' compared in the 'pairwise comparison matrix' (PCM) by the DM, and these imply a 'priority' that contains the eventual ranked preferential order for the items. Typically, in a decision context, the 'items' represent the 'constructs' that are considered w.r.t the 'decision goal', the 'criteria' (hereafter referred to as 'factor') considered w.r.t the construct, or the 'alternatives' justified w.r.t a criterion. An 'AHP hierarchy' is a tree in which all items of the encountered decision are organised according to these 'w.r.t' relationships. If in this tree the items related to the same upper (mother) item and the upper item itself are treated as a 'subtree', then the entire AHP hierarchy simply overlaps these subtrees, e.g., Figure 1.

The main results calculated over the items are 'criteria weights', which represent an essential type of DM opinion on the items and connote a priority. Usually, based on the obtained criteria weights, the AHP involves two 'phases': the first 'criteria weight vector (CWV) determination' phase and the second 'alternative selection' phase. Both phases use a process called 'synthesis' based on the PCM data (Olson, 1996; Bernasconi et al., 2010). Usually, to fill up a PCM with a dimension of $n \times n$, it does not require $n \times n$ but $C_2^n = \frac{n(n-1)}{2}$ times of making a pairwise comparison (i.e., it is also the number of questions a respondent is asked). Another substantial element of the AHP is the consistency check (Saaty, 2003), which verifies the synthesised results. Here, two critical observations are related to the present study.

First, one may obtain the CWVs for the constructs and for the factors in the first CWV determination phase. As these are perhaps the most valuable information about opinions and/or preference structures in potential DMs' mind, this phase alone becomes an effective method to probe (mine) the 'human data' for true DDDM. This argument is evident in the literature. Because of this clear-cut distinction between the two phases of a full AHP, a large number of studies have proposed hybridised MADM models (e.g. a series of 'AHP-XXX' models, where XXX is any other MADM model) (Ho et al., 2013, 2022; Kokangül et al., 2017; Prakash & Barua, 2015; Singh & Rao, 2011; Szulecka & Zalazar, 2017; Zarbakhshnia et al., 2020; Zhuang et al., 2018). Many other studies have simply taken the results obtained from this phase and omitted the next second phase (they have been sufficient for research purposes, such as analysing opinions and the 'addressed points' in aerospace design/evaluation, new business provisioning, law making, etc.) (Chi et al., 2019; Fu et al., 2021; Li et al., 2017; Lin et al., 2021; Tamošaitienė et al., 2021). The present study follows the same logic.

Second, the method of the AHP itself allows collective decision making (Akaa et al., 2016; Aguarón et al., 2019;

Zhuang et al., 2019; Amenta et al., 2021). This concept also holds for this study. As will be demonstrated later, the preference structures of groups during decision making are represented by the opinions of the sample stratifications, each of which contains potential DMs with an identified characteristic, which are then compared and analysed.

3.2. *T*-test

The *t*-test, proposed by William S. Gosset and called 'Student's *t*-test' to hide his identity, has been used for more than a century (Fienberg & Lazar, 2001). Despite being dated, a *t*-test is the most commonly applied (test) (Box, 1987; Kalpić et al., 2011) when the test statistic would follow a normal distribution (Gerald, 2018). This study utilises the independent-samples *t*-test to confirm whether a statistically significant difference existed between the population means of the two series of observational data. During the test, a *t*-value is computed and the corresponding *p*-value is obtained from a table; if the *p*-value is sufficiently small, the difference is considered statistically significant.

In this study, the independent-samples (or two-sample) *t*-test is used under the assumption of homoscedasticity (i.e. that the variances inside the CWVs were homogeneous) and the same sample size (i.e. the measurements of any two variables are equal because a pair of CWVs tested between two groups has the same meaning, as discussed later). For further details about the used type of *t*-test, we recommend (Berkman & Reise, 2012).

Figure 2 summarises the research flow of this study. As can be observed, this study adopted a straightforward waterfall-like flow. It also linked the involved methods that were reviewed.

In this section, we present the studied area, the relevant details of the survey and the main results from the survey (i.e., all calculated CWVs of the effective respondents and the CWV aggregated over them). We tell the differences in opinions between the different pairs of sample groups regarding the same subject.

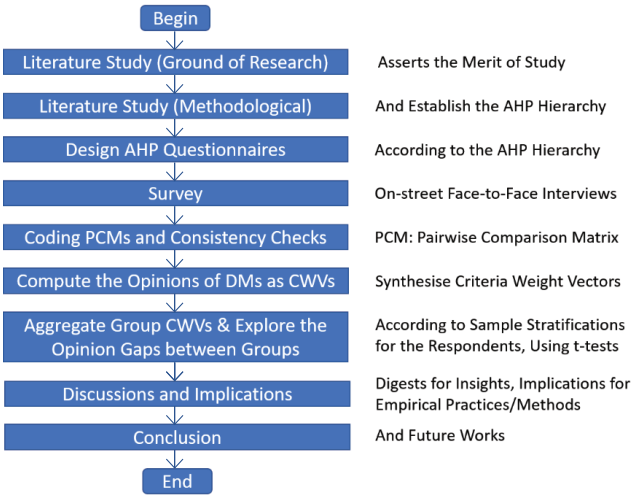

Figure 2. A summary of the research flow

4. Survey, results, and opinion gaps between sample groups

4.1. The area studied

The population density in Taiwan is ranked between 10th and 20th, in the world according to different data sources (Department of Economic and Social Affairs, 2019; UN-Stats, 2021; Wikipedia Cantonese, 2021). However, national-wide data usually makes no sense. For example, Japan's population density does not mean how crowded Tokyo is. Therefore, the lens should be adjusted to a city or metropolitan level, and this also holds for Taiwan, where the results are justified based on.

According to government statistics, the population distribution in Taiwan is very uneven. This is trivial from some public announcements (National Statistics, 2022) or open data (Data.gov.tw, 2021). For example, in Yong-He, a district in New Taipei City, the population density is even higher than in Hong Kong (Chen, 2020a). However, among the six municipalities, the two municipalities in southern Taiwan, Tainan and Kaohsiung, are ranked last (5th and 6th) (852.66/km^2 and 933.48/km^2, respectively), which are far lower than those of the two municipalities in northern Taiwan, Taipei and New Taipei City (9428.77/km^2 and 1959.20/km^2, respectively) (Department of Household Registration, 2021; Wikipedia Traditional Chinese, 2021). This gap is salient, but a more vital observation is that the population densities of these two 'municipalities' surpass the average population density of the island, 648.41/km^2, by only a small margin.

Studying people's niche housing preferences in this less-populated metropolis should be both meaningful and informative for the relevant industries (e.g., as stated previously: construction management, house sales, asset management, etc.). Therefore, our research can focus on gaining knowledge about 'what differs' in this area and take the domestic 'field advantages' to provide necessary supplements to fill the gap in the literature.

4.2. Survey

The survey was administered through on-street face-to-face interviews in Kaohsiung and Tainan from August to September 2021, and interviews were not limited to any district. A respondent was awarded a small gift if he/she answered all questions. Like other studies investigating only residents with housing intensions in this field (see Section 2.2), we filtered the respondents with 'housing intensions' within the upcoming 1~5 years and we confirmed this by an oral question in prior. We believe that this group had sufficiently considered the related matters and was qualified to be our sample because they were going to make a housing decision in the near future. Therefore, a general sample with housing intensions that allowed sample stratification using the respondents' attributes (and subsequent analysis; see 4.4) was obtained. This also affected the questionnaire design at the beginning.

The questionnaire contained five blocks of questions. The first block aimed to obtain a basic profile of the respondent anonymously. It included a dichotomous question for gender (male/female); a numerical question for age (X0–Y0, where X and Y are digits; an interval for age group was defined by answering in this style); multiple-choice questions for which city the individual was born in/grew up in (identical to the one registered for identification), the county/city of current residence, the place of residence (urban, suburb, township, or rural), the location of expected future real estate purchase (urban, suburb, township, or rural), the economic status of their family (multiple-choice annual family income options ranging from <NT$400K, 400K–500K, 500K–600K, …, 1.9M–2.0M, or >2.0M); and open numerical questions for the number of people the respondent was living with and the number of people they planned to live with after an anticipated house purchase.

The second block contained three questions, in the style of the AHP, to allow the respondent to compare three main constructs in a pair-wise manner (i.e. price vs. location, price vs. condition, and location vs. condition). Each question used a 9-level scale, which has been frequently recommended previously (Wind & Saaty, 1980; Saaty, 1990), to poll the relative importance of the construct item on the left compared with the one on the right as perceived in his/her mind (see Table 1). Table 2 displays and translates the design of this questionnaire block.

Table 3 displays a standard PCM composed according to the set of real comparison data collected from a respondent sample. The three bold numbers 7, 5, and 3 are the places that the respondent selected in Table 2 in the rows for 'price vs. location', 'price vs. condition', and 'location vs. condition'. Apart from the diagonal values of 1 (something is always equally important as itself), a lower triangle item is the reciprocal of its associated transposed upper triangle item.

Blocks 3, 4, and 5 in the questionnaire also followed this design logic for a respondent to compare the factors under each of the three constructs: price (CA), location (CB), and condition (CC), respectively (see Figure 1).

Eventually, 68 questionnaires were answered by the interviewees who planned to buy a house in the next

Table 1. Evaluation scales when comparing constructs/factors A and B

Evaluation (criteria A:B)	Definition	Description
1	Equal importance	A is of equal importance as B
3	Weak importance	A is slightly important than B
5	Essential importance	A is moderately important than B
7	Very strong importance	A is strongly important than B
9	Absolute importance	A is dominantly important than B
2, 4, 6, 8	Intermediate values	Interpolation values of the above
1/3, 1/5, 1/7, 1/9, etc.	Reciprocals	Exchange A with B in the above descriptions

Table 2. Block 2 in the questionnaire

(Left☜) is More Important than (☞Right) (Right☞) is More Important than (☜Left)										
Left (A) Item	Dominantly	Strongly	Moderately	Slightly	Equally	Slightly	Moderately	Strongly	Dominantly	Right (B) Item
☜	9:1	7:1	5:1	3:1	1:1	1:3	1:5	1:7	1:9	☞
Price										Location
Price										Condition
Location										Condition

Table 3. A pairwise comparison matrix for the constructs using a respondent's data as an example

Constructs PCM	Price (CA)	Location (CB)	Condition (CC)
Price (CA)	1	7	5
Location (CB)	1/7	1	3
Condition (CC)	1/5	1/3	1

five years and were coded as Excel electronic files. In addition, when the threshold for the CR validation was set as 0.2, as is commonly seen in the industrial applications of the AHP (Schmidt et al., 2016; Klutho, 2013; Zhuang et al., 2017) (and as is the case in the PCM in Table 3), 36 responses successfully passed the consistency check among the 68 PCMs for the constructs. In another set of 41 respondents (also among the total of 68), the PCMs passed the consistency check for the four decision factors under the CA construct. Analogously, 35 (of 68) and 32 (of 68) passed the consistency check for the five factors under the CB construct and the six factors under the CC construct.

Usually, as the number of items compared in a pairwise manner increased, the effective rate of the returned answers decreased. Although this was sometimes true (the DM became more confused when comparing more items), there is no direct explanation for this in the survey (in other words, it is unclear why only 36 of the 68 responses passed the pairwise comparisons for the only three construct items). As the values used for RI at each level of the number of items compared followed the original table in Saaty (1980) and served as the suitable divisor of CR, it should have mitigated this effect. However, they did not.

Hence, another observation is: the effective rates were quite high (36/68, 41/68, 35/68, and 32/68) for these single-round AHP surveys, despite being unable to reach the interviewees for any second-round interview after the on-street interviews (because to avoid distorting the answers we did not collect their contact information) and the 'cold-called' interviewing style (i.e., making a respondent giving arbitrary answers which may lead to the inconsistency of the PCM easily) should be the two main reasons causing the ineffective portion. The main reasons for this observation could be twofold: 1) the interviewers illustrated the purpose, style, and definitions (for the constructs and factors) well prior to conducting each interview, so more respondents could answer effectively in the first round of the survey, and 2) the number of questions asked to construct each PCM did not exceed the psychological limit for most human participants, which is 7±2, in these PCM-style interviews (Ishizaka & Labib, 2011).

4.3. Main results: effective criteria weight vectors

According to the CWV determination process, a CWV was computed for each PCM in which data was collected from a DM. Table 4a summarises and lists the CWVs using the 36 effective respondents whose PCMs for constructs successfully passed the consistency check. The CWVs for the four factors under the price construct (CA), for the five factors under the location construct (CB), and for the six factors under the conditions construct (CC) are shown in other sub-tables.

Table 4. Criteria weight values for the decision makers whose pairwise comparison matrix for the constructs that passed the consistency check

a) Criteria weight values for constructs

CWV for	Price (CA)	Location (CB)	Conditions (CC)
DM1	0.225	0.454	0.321
DM2	0.243	0.088	0.669
DM3	0.321	0.225	0.454
DM4	0.333	0.333	0.334
DM5	0.211	0.102	0.686
DM6	0.429	0.143	0.429
DM7	0.333	0.333	0.334
DM8	0.333	0.333	0.334
DM9	0.6	0.2	0.2
DM10	0.454	0.225	0.321
DM11	0.333	0.333	0.334
DM12	0.429	0.143	0.429
DM13	0.333	0.333	0.334
DM14	0.455	0.455	0.091
DM15	0.333	0.333	0.334
DM16	0.405	0.115	0.48
DM17	0.454	0.321	0.225
DM18	0.75	0.19	0.06
DM19	0.574	0.286	0.14
DM20	0.286	0.14	0.574
DM21	0.321	0.225	0.454
DM22	0.061	0.216	0.723
DM23	0.143	0.429	0.429
DM24	0.09	0.303	0.607
DM25	0.429	0.143	0.429
DM26	0.333	0.333	0.334
DM27	0.714	0.143	0.143
DM28	0.286	0.14	0.574
DM29	0.211	0.102	0.686
DM30	0.102	0.686	0.211
DM31	0.243	0.669	0.088
DM32	0.333	0.333	0.334
DM33	0.143	0.429	0.429
DM34	0.643	0.074	0.283
DM35	0.2	0.2	0.6
DM36	0.2	0.2	0.6

b) Criteria weight values for factors CA1–CA4 under 'price' (CA)

CWV for	House tax (CA1)	Land tax (CA2)	Unit price (CA3)	Loan-related (CA4)
DM1	0.0959	0.1686	0.2725	0.463
DM2	0.365	0.099	0.172	0.365
DM3	0.161	0.484	0.13	0.224
DM4	0.5	0.167	0.167	0.167

CWV for	House tax (CA1)	Land tax (CA2)	Unit price (CA3)	Loan-related (CA4)
DM5	0.234	0.141	0.234	0.391
DM6	0.304	0.129	0.179	0.388
DM7	0.245	0.401	0.161	0.193
DM8	0.25	0.25	0.25	0.249
DM9	0.242	0.192	0.242	0.325
DM10	0.249	0.25	0.25	0.25
DM11	0.161	0.484	0.13	0.224
DM12	0.147	0.322	0.241	0.291
DM13	0.25	0.25	0.249	0.25
DM14	0.25	0.25	0.25	0.249
DM15	0.25	0.249	0.25	0.25
DM16	0.05	0.05	0.45	0.45
DM17	0.038	0.09	0.435	0.435
DM18	0.129	0.179	0.388	0.304
DM19	0.125	0.125	0.125	0.625
DM20	0.322	0.291	0.241	0.147
DM21	0.481	0.282	0.06	0.175
DM22	0.096	0.169	0.463	0.273
DM23	0.234	0.234	0.391	0.141
DM24	0.053	0.097	0.227	0.624
DM25	0.365	0.099	0.172	0.365
DM26	0.463	0.273	0.169	0.096
DM27	0.433	0.054	0.14	0.372
DM28	0.142	0.398	0.398	0.061
DM29	0.0625	0.0625	0.4375	0.4375
DM30	0.064	0.115	0.269	0.511
DM31	0.122	0.122	0.473	0.283
DM32	0.0604	0.2821	0.176	0.482
DM33	0.111	0.059	0.43	0.399
DM34	0.0625	0.3125	0.3125	0.3125
DM35	0.125	0.125	0.375	0.375
DM36	0.212	0.133	0.582	0.074
DM37	0.0886	0.1129	0.533	0.265
DM38	0.463	0.273	0.169	0.096
DM39	0.125	0.125	0.375	0.375
DM40	0.388	0.179	0.304	0.129
DM41	0.094	0.094	0.219	0.594

c) Criteria weight values for factors CB1–CB5 under 'location' (CB)

CWV for	Trans-portation (CB1)	Shop-ping (CB2)	Facilities (CB3)	Feng-Shui (CB4)	District (CB5)
DM1	0.1173	0.4798	0.2013	0.0843	0.1173
DM2	0.166	0.271	0.242	0.126	0.196
DM3	0.2	0.2	0.2	0.2	0.199
DM4	0.2705	0.1645	0.2705	0.0918	0.2027
DM5	0.4629	0.0443	0.0414	0.1279	0.3235
DM6	0.161	0.115	0.312	0.225	0.187
DM7	0.2	0.2	0.199	0.2	0.2
DM8	0.312	0.133	0.12	0.242	0.192
DM9	0.4481	0.2766	0.1278	0.0496	0.0978
DM10	0.296	0.121	0.246	0.181	0.157
DM11	0.225	0.106	0.251	0.194	0.225
DM12	0.2	0.199	0.2	0.2	0.2
DM13	0.233	0.233	0.104	0.197	0.233
DM14	0.273	0.318	0.134	0.129	0.145
DM15	0.346	0.231	0.118	0.118	0.186
DM16	0.142	0.269	0.142	0.18	0.269
DM17	0.5689	0.1668	0.1678	0.0602	0.0362
DM18	0.4825	0.2539	0.0358	0.034	0.1937
DM19	0.1978	0.1058	0.0611	0.4254	0.2099
DM20	0.428	0.305	0.03	0.084	0.153
DM21	0.2402	0.2402	0.0595	0.1803	0.2798
DM22	0.2824	0.1945	0.2672	0.1618	0.0941
DM23	0.1714	0.3731	0.0456	0.0448	0.3651
DM24	0.078	0.2262	0.0419	0.2579	0.3959
DM25	0.2941	0.0588	0.2941	0.2941	0.0588
DM26	0.3218	0.2602	0.0789	0.0789	0.2602
DM27	0.4638	0.2794	0.0432	0.0892	0.1307
DM28	0.2783	0.4318	0.0288	0.0789	0.1822
DM29	0.2464	0.0928	0.1389	0.0422	0.4797
DM30	0.282	0.282	0.121	0.121	0.194
DM31	0.1512	0.4628	0.1328	0.1617	0.0914
DM32	0.1677	0.516	0.0339	0.0871	0.1953
DM33	0.2221	0.5242	0.0496	0.0592	0.145
DM34	0.3333	0.2432	0.0662	0.1444	0.213
DM35	0.2906	0.2443	0.1398	0.0433	0.2821

d) Criteria weight values for factors under 'conditions' (CC)

CWV for	Con-struc-tion mate-rial (CC1)	Cur-rent parti-tion (CC2)	Water/ elec-tricity sys-tems (CC3)	In/out surfaces & looks (CC4)	Com-ple-tion year (CC5)	Water leaking problem (CC6)
DM1	0.1324	0.2445	0.182	0.0928	0.0769	0.2713
DM2	0.167	0.167	0.167	0.167	0.167	0.165
DM3	0.072	0.1833	0.1486	0.172	0.2041	0.2191
DM4	0.167	0.167	0.167	0.167	0.165	0.167
DM5	0.2507	0.132	0.184	0.132	0.183	0.116
DM6	0.258	0.181	0.08	0.114	0.179	0.185
DM7	0.167	0.167	0.167	0.165	0.167	0.167
DM8	0.095	0.149	0.098	0.095	0.095	0.466

End of Table 4

CWV for	Construction material (CC1)	Current partition (CC2)	Water/electricity systems (CC3)	In/out surfaces & looks (CC4)	Completion year (CC5)	Water leaking problem (CC6)
DM9	0.321	0.026	0.245	0.05	0.088	0.088
DM10	0.039	0.094	0.219	0.046	0.285	0.314
DM11	0.158	0.108	0.158	0.227	0.134	0.213
DM12	0.412	0.202	0.143	0.106	0.076	0.058
DM13	0.168	0.043	0.081	0.05	0.245	0.14
DM14	0.171	0.129	0.11	0.228	0.168	0.191
DM15	0.146	0.05	0.093	0.1	0.3	0.309
DM16	0.167	0.167	0.165	0.167	0.167	0.167
DM17	0.269	0.146	0.182	0.058	0.133	0.209
DM18	0.157	0.231	0.118	0.128	0.181	0.181
DM19	0.132	0.189	0.125	0.265	0.105	0.181
DM20	0.187	0.101	0.098	0.028	0.281	0.303
DM21	0.167	0.165	0.167	0.167	0.167	0.167
DM22	0.215	0.224	0.242	0.069	0.073	0.174
DM23	0.049	0.139	0.106	0.031	0.238	0.434
DM24	0.291	0.103	0.166	0.147	0.047	0.244
DM25	0.039	0.395	0.079	0.223	0.145	0.116
DM26	0.179	0.177	0.137	0.198	0.153	0.153
DM27	0.122	0.246	0.282	0.047	0.07	0.23
DM28	0.057	0.203	0.173	0.128	0.106	0.33
DM29	0.453	0.119	0.106	0.11	0.081	0.127
DM30	0.311	0.044	0.049	0.2	0.216	0.177
DM31	0.096	0.204	0.12	0.046	0.22	0.311
DM32	0.138	0.224	0.224	0.037	0.187	0.187

In the results, each effective DM was intentionally assigned a new ID. For example, in Table 4a, DM1 to DM36 indicate DM 4, 5, 6, 7, 8, 13, …, and 68, respectively, in their original order, and so on for Tables 4b, 4c, and 4d. The CWVs aggregated for these effective respondents are significant because they connote the overall group opinions for the potential housing DM population in southern Taiwan. These are:

$$CWV_{\text{Goal}} = \begin{bmatrix} 0.341278 \\ 0.269722 \\ 0.388861 \end{bmatrix} \begin{matrix} \cdots(CA) \\ \cdots(CB) \\ \cdots(CC) \end{matrix}, CWV_{\text{CA}} = \begin{bmatrix} 0.199356 \\ 0.209864 \\ 0.268667 \\ 0.321211 \end{bmatrix} \begin{matrix} \cdots(CA1) \\ \cdots(CA2) \\ \cdots(CA3) \\ \cdots(CA4) \end{matrix}; \tag{1}$$

$$CWV_{\text{CB}} = \begin{bmatrix} .281792 \\ .235619 \\ .152311 \\ .141331 \\ .189117 \end{bmatrix} \begin{matrix} \cdots(CB1) \\ \cdots(CB2) \\ \cdots(CB3) \\ \cdots(CB4) \\ \cdots(CB5) \end{matrix}, CWV_{\text{CC}} = \begin{bmatrix} .172622 \\ .176067 \\ .148425 \\ .142047 \\ .159439 \\ .199206 \end{bmatrix} \begin{matrix} \cdots(CC1) \\ \cdots(CC2) \\ \cdots(CC3) \\ \cdots(CC4) \\ \cdots(CC5) \\ \cdots(CC6) \end{matrix}. \tag{2}$$

Moreover, apart from the relative importance of a factor being justified against other factors under the same construct (e.g., those in CWVCA, CWVCB and CWVCC), the absolute importance of each individual factor can be obtained and ranked. These are displayed in Table 5 overall, and further summarised in Figure 3.

From this analysis, the dominant factors were CA4 (loan-related matters) and CA3 (unit price of estate) (factors w.r.t the CA (price) construct), followed by CC6 (leaking problem) w.r.t conditions (CC) and CB1 (accessibility

Table 5. Local ranks and absolute weights for constructs and individual factors

Construct	Importance (%)	Rank (Local)	Factor (Crit.)	Importance (Local) (%)	Rank (Local)	Importance (Global) (%)	Rank (Global)	Description
Price (CA)	34.1278	2	CA1	19.9356	4	6.8036	7	House tax
			CA2	20.9864	3	7.1622	5	Land tax
			CA3	26.8667	2	9.1690	2	Unit price of estate
			CA4	32.1211	1	10.9622	1	Loan-related matters
Location (CB)	26.9722	3	CB1	28.1792	1	7.6005	4	Accessibility for transport service
			CB2	23.5619	2	6.3552	9	Nearby shopping functions and areas
			CB3	15.2311	4	4.1082	14	Facilities (including the undesired, too)
			CB4	14.1331	5	3.8120	15	Feng-Shui
			CB5	18.9117	3	5.1009	13	District/town level
Conditions (CC)	38.8861	1	CC1	17.2622	3	6.7126	8	Construction material
			CC2	17.6067	2	6.8466	6	Current internal partition
			CC3	14.8425	5	5.7717	11	Water and electricity systems
			CC4	14.2047	6	5.5237	12	Walls/floors' health and looks
			CC5	15.9439	4	6.2000	10	Completion year (i.e., house age)
			CC6	19.9206	1	7.7463	3	Leaking problem

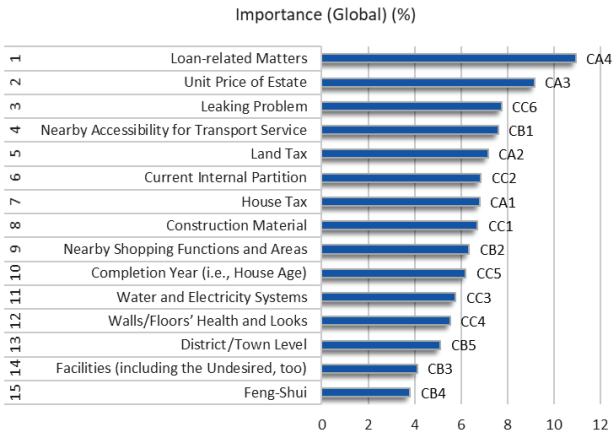

Figure 3. Ranking of individual factors

to transport service) w.r.t location (CB). The importance of the two topmost price factors were salient.

By contrast, the two least impactful factors were both w.r.t the CB construct: facilities (CB3) and feng-shui (CB4). This is surprising because we included CB3 following the recent trend in the literature to address the relevant effects of wanted or unwanted facilities (e.g., funeral), and we included CB4 because of the studies conducted in southern Taiwan that addressed the topic of 'feng-shui'. However, these two location factors were perceived as having very low importance according to the potential buyers.

A further (and perhaps the most significant) finding revealed that house conditions (CC), which has not been addressed in either north or middle Taiwan, outranked the other two constructs in southern Taiwan. Moreover, no specific factor under this construct was deemed unimportant, and this could be the reason why this construct was perceived as the most important. In addition, price (CA), which has been regarded as important in some studies conducted in middle Taiwan but is almost neglected by studies in northern Taiwan, was another major concern to the potential housing DMs in southern Taiwan, but its importance (34.13%) was below the importance of CC (38.89%).

Compared with CA and CC, location (& transportation) (CB) only had an importance of 26.97%. This is reflective of the theory that location is the least important consideration in southern Taiwan's real estate market, and it can be attributed to the differences which exist between the two ends of Taiwan, as discussed in Introduction and Section 1 (e.g., population density and/or geography). However, among the factors under CB, the accessibility to the public transport function (CB1) remained the fourth critical factor that dominated housing decisions overall. This violates common sense, as it does not reflect what was previously reported.

4.4. The opinions of different sample stratifications

According to each respondent attribute identified in the 'profile' block of the questionnaire, the opinions of the different respondent groups (sample stratifications) are analysed. The analysis emphasises distinctions between the opinions of different groups.

Table 6 presents the opinions of different genders under the three constructs. There was no evidence that males and females differed in their opinions on the factors under CA (price) and CB (location) (p-values ~1). In addition, there was no evidence of any distinction between males and females in their opinions on the factors under CC (conditions), with the p-value not reaching 0.1 (p = 0.1185). That is, the opinions of males and females did not vary under any constructs.

Table 7 shows the opinions of different age groups under the three constructs. In this table, the diagonal is greyed to indicate meaningless comparisons, but unlike Table 6, the lower triangle is intentionally eliminated for simplicity because of the symmetry of this type of table (see the upper and lower triangles in Table 6). From this table on, we use different shades of green to mark the three levels of statistical significance based on the p-value (i.e., <0.1, <0.05, and <0.01). Weak evidence showed that young people and middle-aged people differed in their opinions on the factors under the CB (location) construct (p = 0.09194). In addition, the evidence showed a significant difference between young people and older adults for the factors under CC (conditions) (p = 0.01209) and between middle-aged people and older adults for the factors under CA (price) (p = 0.01304). Moreover, there was a significant difference in the opinions under the CC

Table 6. Opinions of different genders under each construct

MALE					FEMALE	
MALE					Price	t = 8.1966e-05 p = 0.9999
					Location	t = 8.1966e-05 p = 0.9999
					Conditions	t = −1.8822 p = 0.1185
FEMALE	Price	t = 8.1966e-05 p = 0.9999	Location	t = 8.1966e-05 p = 0.9999	Conditions	t = −1.8822 p = 0.1185

(conditions) construct between middle-aged people and older adults ($p = 0.003095$).

This finding is interesting because the most serious opinion conflict for house conditions occurred between these two groups, and the conflict between the 'two extremes' (young people and older adults) was low. Together with the observation that these two groups also had conflicting opinions on house price considerations, but all other pairs of groups did not, this finding suggests that the theory of 'generation gap' does not apply for these opinions.

Table 8 analyses the opinions of people with different annual income levels. Note that we used the economic status of the family instead of the income of the respondent (see Subsection 2.1) because this mitigates the effect of individual outliers, and a house purchase decision in East Asian culture should depend on other family members, too (see Introduction).

These results are interesting. People from high-income families have different opinions from other groups of people from lower income families for the factors with respect to CB (location). A further examination revealed that they think very differently from people in middle-income families and slightly differently from people in the low-income families. For the same subject, no difference was observed between the low-income and middle-income groups, and no other difference was observed between any other pair of groups for either CA (price) or CC (conditions). These facts reveal that the unique perceptions of people from the high-income families regarding the location factors are extraordinary. Such knowledge is prominent for marketing (e.g., for agents, construction companies, etc.).

Table 9 examines the opinions of respondents classified according to the number of people they lived with. This 'level of co-residence' is often important because the family structure in East Asian societies should be special

Table 7. Opinions of different age levels under each construct

	YOUNG	MIDDLE					ELDER					
YOUNG		Price	$t = 0.62584$	Location	$t = 2.2069$	Conditions	$t = -0.048439$	Price	$t = -0.29785$	Location	$t = 0.33121$	Conditions	$t = 3.8427$
			$p = 0.5758$		$p = 0.09194$		$p = 0.9632$		$p = 0.7853$		$p = 0.7571$		$p = 0.01209$
MIDDLE								Price	$t = 5.3096$	Location	$t = 1.3598$	Conditions	$t = -5.3375$
									$p = 0.01304$		$p = 0.2455$		$p = 0.003095$
ELDER													

Table 8. Opinions of different income levels under each construct

	LOW	MIDDLE					HIGH					
LOW		Price	$t = 1.0476$	Location	$t = -0.27181$	Conditions	$t = 1.2539$	Price	$t = 0.68496$	Location	$t = 2.6258$	Conditions	$t = -0.19622$
			$p = 0.3718$		$p = 0.7992$		$p = 0.2653$		$p = 0.5425$		$p = 0.05844$		$p = 0.8522$
MIDDLE								Price	$t = 0.29966$	Location	$t = -4.9289$	Conditions	$t = 1.0318$
									$p = 0.784$		$p = 0.007879$		$p = 0.3495$
HIGH													

Table 9. Opinions of groups with different levels of co-residence under each construct

		LESS						MEDIUM						MORE					
LESS								Price	$t = -1.0899$	Location	$t = 1.0099$	Conditions	$t = -3.2508$	Price	$t = 1.4424$	Location	$t = -1.1991$	Conditions	$t = 0.39112$
									$p = 0.3555$		$p = 0.3697$		$p = 0.02268$		$p = 0.2449$		$p = 0.2967$		$p = 0.7118$
MEDIUM														Price	$t = -3.4525$	Location	$t = 2.449$	Conditions	$t = 4.5907$
															$p = 0.04086$		$p = 0.07052$		$p = 0.00589$
MORE																			

(see Introduction), i.e., there are conjugal families, consanguine families, and eclectic families between them. In this study, the co-residence level was classified into 'less', 'medium', and 'more'.

From the results, the largest differences occurred between people with the 'medium' level of co-residence and those with the 'more' level of co-residence. These two groups disagreed with each other on all aspects, and weak, moderate, and strong evidence showed that they disagreed on the importance of the 'location' factors, 'price' factors, and 'conditions' factors, respectively ($p = 0.07052$, $p = 0.04086$, and $p = 0.00589$). Apart from these, only people who lived with fewer co-residents had a different opinion from people who lived with a medium number of co-residents ($p = 0.02268$).

It could therefore be asserted that the opinions of the 'more co-residents' group and those of the 'less' group were more homogeneous than any other combination of groups. Therefore, along with the finding that opinions of the 'more' group and those of the 'medium' group were more heterogenous, another new empirical insight is that in southern Taiwan, when making a housing decision, people who live with more co-residents agree with the opinions of people who live with less (or no) co-residents, rather than with those who live with a medium number of co-residents.

Regarding the opinions of the four sample groups stratified by place of residence (urban, suburb, township, and rural, from the city centre to the countryside), under the price construct (CA), we found only a slight difference between the opinions of people who lived in township areas and those living in rural areas ($t = 2.5177$ and $p = 0.08635$) among all C_2^4 (=6) pairs of groups (undirected). This can be ignored because the only statistically significant value of p approached 0.1, which is the boundary between 'slight difference' and 'no difference'. Under the location construct (CB), there was no difference between the opinions of any two groups, and there was no difference between groups regarding the opinions on the factors under the conditions construct (CC). In this regard, it was confirmed that for the opinions under all of the constructs, the place of residence of a respondent was unimportant.

5. Discussions and implications

Findings and the insights gained in Section 4 are valuable because the results themselves are empirical and interesting, so that many existing arguments can be either supported or refuted. This knowledge is worthwhile just because in the literature, there is a lack of such a 'systematic study' (see Introduction). Anyhow, these have drawn implications for further actions in practice.

First, the insight that the place of residence of a respondent is not an important factor in their housing decision may indicate that some attributes of the potential house buyers can be ignored when promoting or selling real estate (in contrast to the 'effective characteristics').

Second, in contrast to the conclusions drawn in the extensive literature on the very densely populated northern Taiwan for which location, transport, and living functions have been considered, housing conditions, price and location were addressed in southern Taiwan. And for middle Taiwan with an intermediate population density, there is also an 'intermediate' set of decision constructs containing location, living functions, and price. For these please also see the literature studied in Section 2. Figure 4 illustrates the 'non-paradigmatic shifts' in housing preference structure for (on) a circle of constructs.

As clearly shown in Figure 4, from the north to the south, price began to replace transport in middle Taiwan, and housing conditions eventually replaced living functions in southern Taiwan. In other words, the main considerations gradually shifted from the north to the south

in Taiwan, in parallel with the decreasing population density in these areas. Such unforeseen knowledge is novel and valuable for potential homebuyers and practitioners in relevant industries (see Section 1).

Third, before this study, a question remained as to why the Mass Rapid Transit (MRT) system in Kaohsiung carries only one-tenth of passengers (trips) per day compared to Taipei (Li, 2017), which underscores a survival problem for the MRT operation. Surprisingly, this question can be answered by this study: because people perceive location and transport as not their main concerns when making housing decisions, they are motivated to drive or cycle (or ride) to commute or travel, a situation observed through field study (Zhang, 2021).

Fourth, after performing the survey (with questionnaires designed according to the credible AHP hierarchy established from the literature review), the respondents' opinions were assessed based on the PCM data, and group opinions on the relative importance of the constructs and of the factors (w.r.t the same construct) were aggregated for the effective respondents. A final rank order was justified for all factors on the basis of their absolute weights. These results provide the following insights:

1. Loan-related matters (CA4) and the unit price of the estate (CA3), both of which were under the price construct, were the leading factors for people in southern Taiwan when making housing decisions.
2. By contrast, wanted or unwanted surrounding facilities (CB3) and feng-shui (CB4) were the least important factors. The low importance of CB3 is the opposite of the general trend in Taiwan for this factor in house-selling, and the low importance of CB4 conflicts with the conclusions drawn in recent studies of the same area.
3. Housing conditions (CC), which were not deemed important to two other areas in Taiwan, eventually dominated price (CA) and location (CB) in the investigated area, while no specific factor under CC was deemed unimportant in general.
4. Price (CA) was also important to southern Taiwan, as to middle Taiwan but in contrast to northern Taiwan.
5. Location (CB) carried only one-fourth of the importance. This is reflective of the reasons observed in this area in the literature. However, access to transport functions (CB1), despite being integrated into this construct, remained one of the dominant factors, and was ranked fourth overall.

Finally, the opinion gaps identified across the different sample stratifications are also interesting because they

Figure 4. Non-paradigmatic shifts in housing preference structure for a circle of constructs

Table 10. A summary of between-group differences

Sample stratified by …	* Slight diff.	** Moderate diff.	*** Salient diff.
Gender (Male/female)	n/a	n/a	n/a
Age (Youth people/middle-aged/elderlies)	Youth people & middle-aged under CB	Middle-aged & elderlies under CA; youth people & elderlies under CC	Middle-aged & elderlies under CC
Family income level (Low/middle/high)	Low income & high income under CB	n/a	Middle income & high income under CB
Level of co-residence (Less/medium/more)	Medium & more under CB	Medium & more under CA; Less & Medium under CC	Medium & more under CB
Place of residence (Urban/suburb/township/rural)	Township & rural under CA	n/a	n/a

imply circumstances of the entire population. Table 10 summarises the between-group differences identified in the analysis:

1. The discussed insights in Section 4.4 are all valuable and important in practice.
2. The identified pairs of groups that strongly disagreed with each other are informative.
3. In any stratification of respondents, both opinion gaps and opinion coherences can be observed between pairs of groups. For example, in terms of the level of co-residence, the opinions of the 'more' and 'less' groups were homogeneous compared with those of the 'more' and 'medium' groups, which were completely heterogeneous.
4. Age, family income, and level of co-residence were the 'effective characteristics' of a respondent that influenced housing decisions in this area, whereas gender and place of residence (living morphology) were not. Thus, this mind-mining process reveals whether or not each characteristic is effective for differentiating between potential buyers.

In summary, in view of the findings, insights, and implications, this study establishes empirically derived knowledge that should be valuable in real-world practice for relevant industries/parties and potential homebuyers (see Introduction and Section 4.1). It also verifies the proposed flow that weaves the analytical methods together, which is another potential contribution of this study.

Conclusion

This study aimed to probe the relevant knowledge about the constructs/factors and preference structures in housing decision-making in East Asia. The twin-city metropolis in southern Taiwan, being far less populated than those in the northern region, was selected as the study area. In general, this scientific study demonstrates the subtle differences in housing considerations between people living in nearby metropoles, which arise with gradual demographic and geographic changes under a relatively homogeneous setting within the greater scope of area (see Figure 4). As the literature lacks a systematic focus on this topic, such an outcome is valuable for real-world practice.

This study also extends the literature by presenting empirical yet numerical knowledge that should be valuable for potential homebuyers and provides up-to-date and wide-ranging information for industries. Several findings also reflect on previous observations which simply lacked theoretical support, whilst some existing claims are refuted by the contradictions shown. See the summaries and implications in Section 5.

In addition, a methodological flow combining the credible methods is proposed in this study (Figure 2), which is verified by applying it to the topic studied. This is the main scientific innovation of the study. Note that by following other empirical socio-scientific or decision-oriented surveys conducted in East Asia (Wu et al., 2018; Fu et al., 2021) conservatively, this study polled the respondent profile, too. Since this type of information is likely to put the respondent at a disadvantage and another 'final block approach' commonly used with the contingent value method (Stellin & Rosato, 1998; Nunes & Nijkamp, 2007; Roscelli, 2014) is also possible, the effect(s) of that approach can be examined in the future.

Future lines of research are proposed based on either the application potential of the above flow or the findings/implications of this study in relation to consumer behaviour/psychological patterns and socioeconomic/managerial aspects. Similar systematic surveys may be conducted in other areas of East Asia with similar cultural backgrounds using the same flow, so that people's preference structure for housing in each area can be assessed actuarially and the results can be compared. The effects of factors influencing housing decisions, other than population density alluded to in the literature or the geographical conditions of a metropolis identified in this study, can be scrutinised. The same topic can also be studied globally. Such cases should enable cross-cultural comparative analysis, for example of Western cultures or other Asian cultures, such as Indian and Middle Eastern in South Asia.

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Author contributions

Z.-Y. Zhuang and C.-H. Fu conceived the study and were responsible for the design of the study. Z.-Y. Zhuang was responsible for the design and development of the data analysis, data collection, and data interpretation. Z.-Y. Zhuang wrote the first draft of the article. Z.-Y. Zhuang and C.-H. Fu were in charge of the revisions. C.-H. Fu paid for the four professional proof-reading service rounds and the possible charges incurred for publication, although Z.-Y. Zhuang was in charge of a relatively larger part of the surveys and research works.

Disclosure statement

The authors do not have any competing financial, professional, or personal interests from other parties.

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