

Popular Attributes Selection in Formulating Control Variables of House Preference for Assisting Hedonic Pricing Model in Malaysia

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Abstract: *The house is a vital facility with a high financial investment portion of livelihood. Many studies discovered the significant variables influencing willingness to pay (WTP) for house preferences using the hedonic pricing model to reveal the living needs. Numerous literature reviews have been done on the theory's functional models, methodology, and application. However, less focus has been given to the appropriate control variables applied in the model according to the location. Thus, researchers often needed help identifying the suitable variables to be adopted as the control attributes possibly influencing WTP for the hedonic pricing model to minimize the model's misspecification or over-specification. Hence, this study aims to review the empirical house preference variables, mainly in Malaysia case studies, and identify the popular attributes based on functional categories and their impact on the WTP. The identification narratively uses 35 articles from five scholarly databases and discovered 87 empirical attributes categorized into four functional variables: 'locational and neighbourhood,' 'building's structural,' 'natural and environmental,' and 'socio-related.' This reveals the understanding of house preferences so that a proper data acquisition process, methods, and model functional forms can be prudently considered when dealing with the hedonic pricing model in developing countries, specifically Malaysia.*

Keywords: hedonic pricing, house, attribute, review

1. Introduction

A house is an essential facility for living and has become the most considerable portion of investment in a household (Hassanudin Mohd Thas & Sakaran, 2016). A house is valued not only for the cost of construction and location but also with numerous implicit attributes (e.g., environmental and socio-economic) to increase the quality of life (Hui Yap et al., 2019). In addition, due to urbanization, the consideration of appropriate amenities or the disamenity effect of variables in the house selection would also affect the decision-making for upholding the living quality since urbanization has brought various improvements in infrastructure, access to multiple facilities, and opportunities that would benefit well-being (Wu et al., 2022). Discouragement of decent amenities, especially concerning living qualities and well-being, would contribute to health problems such as stress, cardiovascular health, and obesity (World Health Organization, 2018). Due to extra emphasis on living with a good value, residential preferences have become essential to decision-making. Thus, modeling the house preference

would provide a comprehensive insight to ensure supply feeds demand in sustainable living quality.

One technique for modeling preferences is called revealed preference. There are a few markers of revealed preference, such as hedonic pricing, hedonic wage, travel cost, or averting behaviour. Hedonic pricing is among the most famous and advanced (Abidoye & Chan, 2016; Pagourtzi et al., 2003) formulated by Rosen (1974) and defined as the implicit prices of variables that reveal the specific amount of associated characteristics. The hedonic pricing approach has been extensively used worldwide in estimating characteristics in the willingness to pay (WTP) for various types of monetary transactions, for example, in retail goods, services, and brand preferences (see Childers et al., 2001; Kuikka & Laukkanen, 2012; Rigall-I-Torrent & Fluvia, 2011). The application of hedonic pricing can quantify the non-monetary elements, such as the environmental externalities, using the property value input as the monetary benchmarking (Catma, 2021). Thus, Xiao (2017) has acknowledged the hedonic pricing method as the most common approach to analysing characteristics based on house price as property value input.

The discussion of methods, models, applicability, and issues of hedonic pricing method for property valuation had been previously reviewed by many researchers around the globe (see Chin & Chau, 2003; Herath & Maier, 2010; Owusu-Ansah, 2013; Usman et al., 2021; Xiao, 2017; Yoo & Wagner, 2016). They provided detailed insight on using appropriate functional forms of hedonic pricing models or variables that can be selected cautiously for any applications. However, in choosing relevant variables, the possibility of misspecification are almost inevitable (Chin & Chau, 2003), and the collection of a large amount of data may also not always be available and requires serious concern in cost and time (Aladwan & Ahamad, 2019; Locurcio et al., 2020). Thus, the precaution in selecting or limiting the potential explanatory variables is vital to ensure that the analysis performed is fit enough for the study.

The set of attributes in hedonic pricing models requires appropriate control variables to be incorporated with the focus variables. The control variable is defined as the attributes being applied in the model, potentially affecting the WTP but not necessarily the focus of the study (Mohd Faris Dziauddin, 2013). In the meantime, minimizing or limiting the effect of the misspecification of variables in the model is crucial. Thus, selecting appropriate control variables is essential. The proper use of control variables enhances the model variation explanation by providing a better coefficient of determination (R^2). Xi, Tang, and Feng (2022) proved an increment in the degree of the variable's explanation from 0.28% to 60.47% when the gradual introduction of attributes, from only three (3) to eleven (11) utilized attributes, was made in the model for rental house market in Beijing, China. Mohd Faris Dziauddin (2014) also shows a similar situation when the increment of 12.4% coefficient of determination in the model capitalized on the building's structural and locational variables compared to only the building's structural variables' model in determining the house price in Selangor, Malaysia. This has demonstrated the importance of identifying the appropriate set of variables and capitalizing the control and focus variables selected in the hedonic pricing model to indicate the WTP for the house.

Mohd Faris Dziauddin (2014) and Scheurwater (2017) mentioned that, when it comes to the house price application, its implicit values of characteristics had a major influence by the geographical location of the properties. Hence, the inclusion or omission of potentially significant variables can be based on the house's location. Even though a vast number of research studies have proven the critical variables in the correlation between house value and

its implicit characteristics worldwide, the suitability of the variables to be used in the developing country's local context might be questioned. The application of the hedonic pricing model with implicit variables for house value can be seen through a few empirical pieces of evidence, for example, in the existence of Light Railway Transit (LRT), open space, and the effect of flood events (see Mohd Faris Dziauddin, 2014, 2019, 2021; Muhammad Najib Razali et al., 2021; Norzailawati Mohd Noor et al., 2015; Nur Hafizah Ismail et al., 2019; Nur Syafiqah et al., 2017, 2018), a critical review on the impact of variables is necessary to provide a detailed picture on the determinant characteristics of the WTP for the house in Malaysia for optimizing the hedonic pricing model development.

Several review articles are also found among Malaysian researchers regarding the hedonic pricing model (see Aladwan & Ahamad, 2019; Chin & Chau, 2003; Hamza Usman et al., 2020; Muhamad Hilmi Mohamad et al., 2016; Norhaya Kamarudin et al., 2008; Suriatini Ismail, 2006). However, most of the articles are mainly concerned with the issue of the model's application and methodology of the analysis, and less attention is given to the appropriate choices of attributes and variables. Even though there is empirical evidence of hedonic pricing model application in Malaysia, variable selections rely muchly upon foreign countries. Schaeffer and Dissart (2018) noted that the local impacts are mainly subjective in nature and community, where they cannot be displaced to another location, especially for hedonic pricing model applications. Therefore, the actual impact of each variable in a developing country such as Malaysia remains decompiled and needs to be investigated. Including more control variables in the model is advisable, potentially avoiding or minimizing misspecification (Kim et al., 2020; Wen et al., 2020).

Thus, this review aims to identify the popular attributes of house preference used in Malaysia to assist the hedonic pricing model's case study. This article is prepared to study the empirical selection of control variables based on functional categories for house preferences and how they impact the model to achieve the aim. This would deliver a meaningful choice of control variables to precisely understand the focus variable demonstrated by the hedonic pricing model, especially in developing countries.

2. Materials and Methods

This article is written using the narrative review technique. Research articles are searched from a few databases such as Scopus, Science Direct, Web of Science, ProQuest, and the Malaysian database, MyJurnal. The search process was carried out on 14 September 2022 using the keywords 'Hedonic,' 'property valuation,' 'real estate,' and 'Malaysia' to narrow the search process to the Malaysian standpoint. To provide a general house variable preference, a few pieces of empirical evidence that had been analysed using other statistical approaches (e.g., factor analysis, other multiple regression models, fuzzy weighting, etc.) listed under the same searching process are also included to complement the final sorted articles and support the result's discussion.

After the search, several articles were filtered out when they were redundant or did not contain house preference attributes. The review is limited to the research articles published only in English. The papers are then grouped into two (2) document groups (hedonic pricing method and others) and four (4) code groups (building structural, locational and neighbourhood, natural and environmental, and socio-related) using Atlas.ti software. The category of 'others' as a document group consists of the empirical results of non-hedonic pricing models, such as by factor analysis, fuzzy weighting, or descriptive statistics. Each observed attribute found in the

article is coded once, and the popular utilized attributes are defined based on the total number of codes. They would indicate how often a code has been applied throughout all reviewed articles.

3. Result and Discussion

The output from the search process discovered 2,498 articles from five (5) databases [Scopus (125), Science Direct (1,086), Web of Science (293), ProQuest (947), and MyJurnal (49)]. Through the title, 47 articles have been selected after removing redundancy and related to property valuation or real estate in Malaysia only. By reading further on the article's content, only 35 articles are sorted by eliminating those research papers in which the variables were not statistically analysed or unrelated to the house preferences criteria. About 68.6% (24) of the manuscripts consisted of empirical results from applying the hedonic pricing method. In comparison, only 31.4% (11) were categorised as 'others,' which is the non-hedonic analysis approach (e.g., factor analysis, fuzzy weighting, descriptive statistics, etc.), potentially used to complement the necessary variable of house preferences. Most study areas for the empirical research are in fast-developing urban states in Malaysia, such as Selangor (11), Kuala Lumpur (8), and Johor (7), possibly due to the high demand for houses in those areas. Three (3) research articles covered Peninsular Malaysia related to flood and crime issues (Nur Hafizah Ismail et al., 2016; Wong et al., 2020). The list of 35 research papers reviewed in this study is attached in Appendix 1.

Attributes related to types of houses are merged based on similar characteristics. For example, terraced, semi-detached, and condominium are consolidated under 'house type.' It is also applied to the use of other variables like the 'existence of school within a certain range of distance represented by dichotomous value' and 'nearest distance to school' or even distinguished attributes based on distance according to the type of schools (e.g., primary, secondary, or high-performance schools), are combined into one single attribute as 'proximity to the school.' The combination is due to the similarity of preferences: the distance to the preferred place. Consequently, 87 attributes are presented and classified according to their functional categories. Table 1 shows the defining categories and the number of involved details from 35 reviewed articles.

Functional categories of variables

Since no absolute functional categories are in a standardized outline, this article proposed the classification of the available categories into four (4), as shown in Table 1, to accommodate the discovered attributes within 35 reviewed articles. Functional categories are presented to ease the identification of variables throughout the review process. Based on the variable's code groups, the highest number of attributes is the 'building's structural variables' (BSV), followed by 'locational and neighbourhood variables' (LNV), 'natural and environmental variables' (NEV), and lastly, 'socio-related variables' (SV). Table 1 also represents the number of coded attributes based on their functional category. Figures 1-4 show the entire coding attributes according to their functional category. In the following section, we will delve solely into the prevalent coded attributes for BSV and LNV, owing to their significant potential for employment as control variables in any application of a hedonic pricing model. The detailed discussion is based on the indication criteria for each functional category, either analysed through hedonic or non-hedonic pricing models. The significance indicators mentioned are primarily based on the p-value in the regression result with at least $\leq 10\%$ significance level or the significant value of factor loading (>0.4) where applicable.

Table 1: Number of attributes in the functional category

Functional categories	Notes	Number of coded attributes
Building structural variable (BSV)	Related to building physical structure information.	36
Locational and neighbourhood variable (LNV)	Related to the location factor, such as proximity in distance, time, or existence of facilities, information.	20
Natural or environmental variable (NEV)	Related to natural or environmental resources, amenities, or disamenity information.	20
Socio-related variable (SV)	Associated with the social, cultural, economic, or demographic information.	11
Total		87

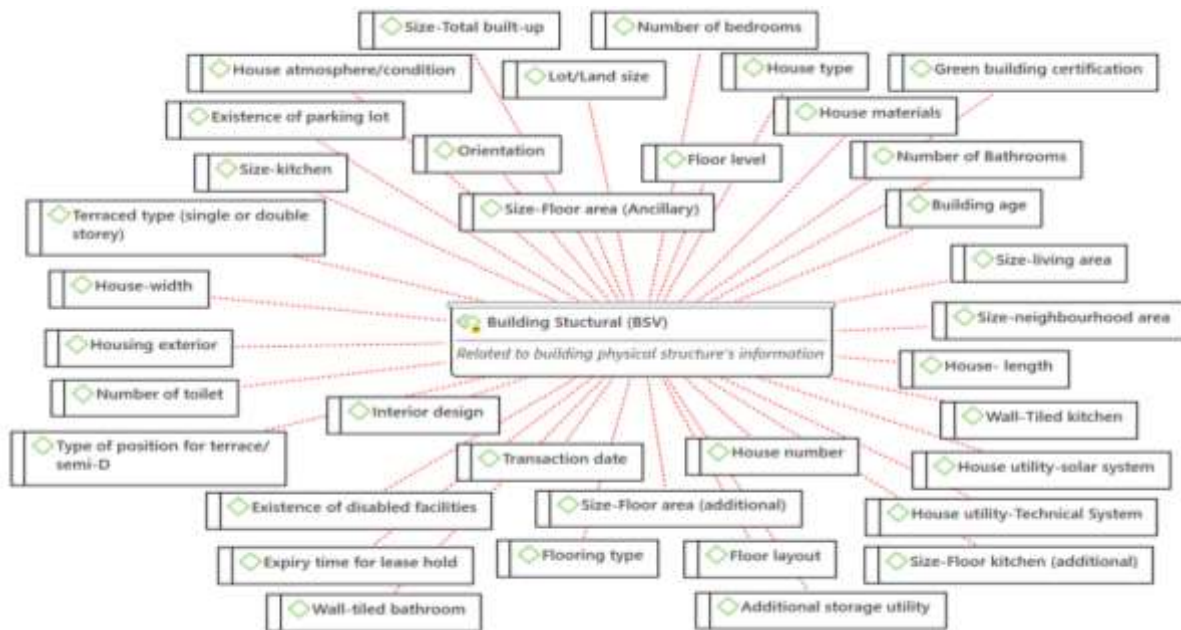


Figure 1: Attributes for building structural variables (BSV)

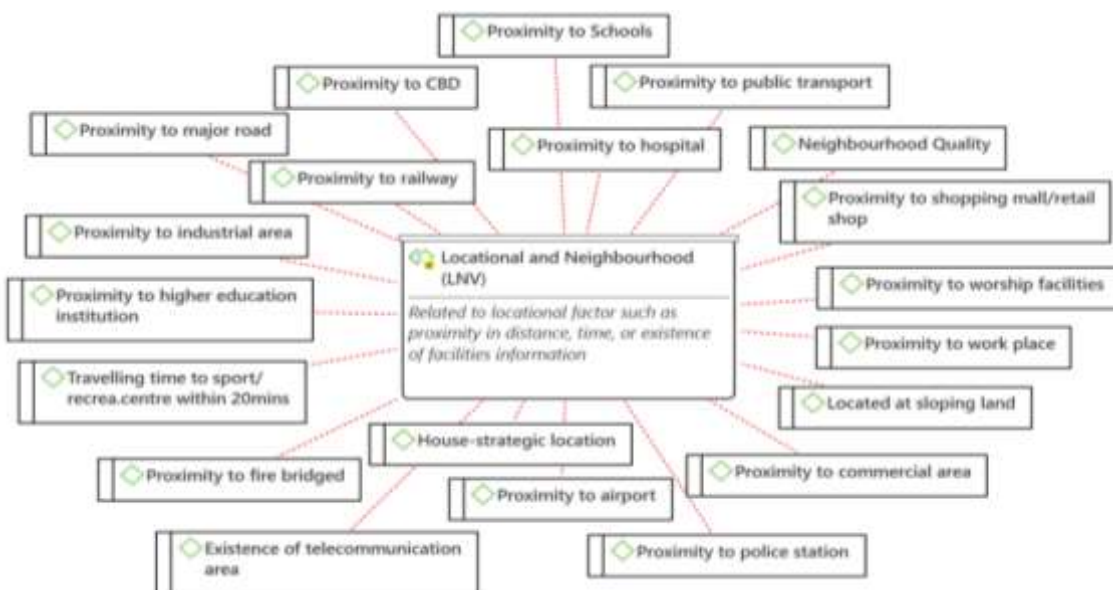


Figure 2: Attributes for Locational and neighbourhood variable (LNV)

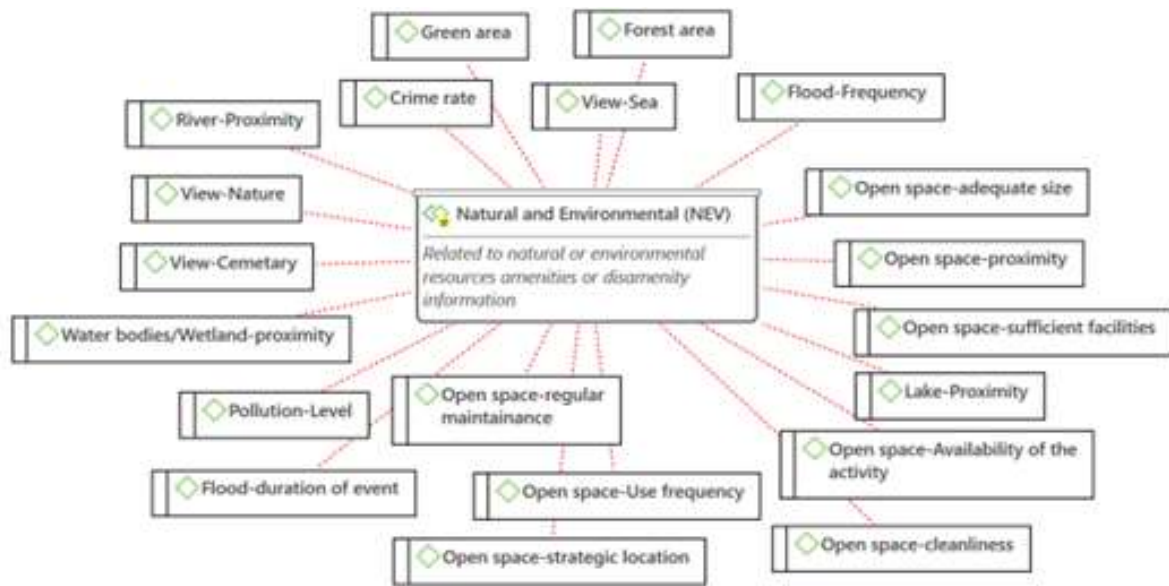


Figure 3: Attributes for Natural or environmental variable (NEV)

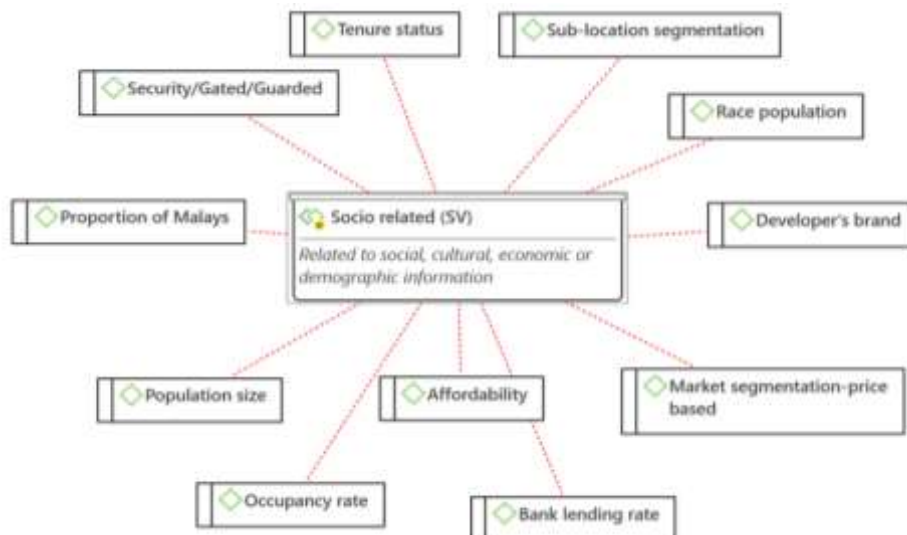


Figure 4: Attributes for Socio-related variable (SV)

Building structural variable (BSV)

Table 2 shows the top five (5) coded empirical variables utilization out of 36 BSV code attributes mentioned within 35 reviewed articles for Malaysian WTP for the house from Atlas.ti software. The BSV's attributes are the highest number of coded variables, probably because the data can be quickly and accurately obtained from various sources such as grant certificates, valuation departments, real estate company databases, or property website advertisements. The highest number of attributes coded in the reviewed articles represents the total built-up area of 20 times. Built-up area is meant by the term 'built-up size,' 'floor size,' or 'floor area.' The measurements are usually square meters (m²) or square feet (ft²). From the twenty (20) coded results, sixteen (16), three (3), and one (1) are coded as significant with a positive coefficient, significant with a negative and not significant, respectively. The significant positive means that the bigger the house size, the higher the price people are WTP (Mohd Faris Dziauddin et al., 2013; Mohd Faris Dziauddin, 2021). Although the other three pieces of evidence (Abdulazeez Umar Raji, 2018; Chin et al., 2004; Lizawati Abdullah & Thuraiya Mohd, 2022) resulted in a negative coefficient, they had a relatively small magnitude (-0.0034 to -1.460), indicating their

low influence on the WTP. According to factor analysis, a study by Siti Mahfuzah Sarif et al. (2018) found that the character of the built-up area is considered a necessity rather than a preference. This provides a solid rationale for including a 'built-up area' in developing a hedonic pricing model. 'Lot/land size' has also been deemed crucial in numerous reviewed articles and found in the third rank of popularity. Extensive empirical research has proven that 'Lot/land size' coding significantly impacts all fourteen (14) instances.

Table 2: Top five (5) numbers of variable's utilization for BSV

BSV's attributes	Total coded
Total built-up area	20
Number of bedrooms	16
Lot/Land size	14
House type	12
Building Age	11

The number of bedrooms is represented in 16 times of coded attributes. The measurement unit used for expressing the number of rooms is either the actual quantity or the dichotomous value (e.g., the value is one (1) if the number of rooms is/more than three or zero (0) if less than three). Eleven (11) empirical results showed significance with a positive coefficient value, while one (1) and four (4) indicated significance with a negative coefficient and non-significant, respectively. The significant positive coefficient value indicated that the more room provided, the higher the WTP for the house. However, the possible reason for the non-significant results is the inappropriate use of dichotomous values (Abdul Hamid Mar Iman, 2007; Suriatini Ismail, Taher Buyong, et al., 2008). The quantity of bedrooms is a crucial factor influencing WTP, rather than just a mere preference. This was also discovered in a factor analysis conducted by Siti Mahfuzah Sarif et al. (2018).

The fourth-ranked is the house type. It has been coded twelve (12) times during attributes reviews, representing the type of cluster house, flat, condominium, detached, semi-detached, and terraced (Mohd Faris Dziauddin, 2013, 2014; Mohd Faris Dziauddin et al., 2013). The cluster houses and flats were found to be significant with negative coefficients, while the others had significant positive values towards WTP (Mohd Faris Dziauddin, 2014). Even though it was found to influence the price significantly, most of the other research only considers a single type of house to measure the WTP (Abdulazeez Umar Raji, 2018; Mohd Faris Dziauddin, 2019a, 2019b, 2021; Mohd Faris Dziauddin & Mustika Misran, 2016). It is wise to understand that the house type fit in any hedonic pricing model only when a multitype of sample or sub-market is involved. Still, it is more important to ensure that a homogeneous sample is used in the research where the focus samples selected based on the specific type of house can provide the representation of a homogeneous and equilibrium market (Xiao, 2017).

The building age had been capitalized with eleven (11) coded attributes in the reviewed articles. The age was generally defined by the actual transaction years minus the building's constructed years. It is found to have a variate impact on the WTP for the house. Five (5) significant attributes are identified, with the negative sign possibly influenced by higher maintenance costs for older properties, leading to a lower WTP (Chin et al., 2004; Nur Hafizah Ismail et al., 2019; Nur Syafiqah et al., 2017, 2020; Suriatini Ismail, Abdul Hamid Mar Iman, et al., 2008). However, when the township's maturity or aesthetical value is considered, WTP might be higher even for the older properties. This was probably the reason for two (2) other researches that were found to be positively significant (Abdulazeez Umar Raji, 2018; Nurul Nazyddah Mat Nazir et al., 2015). Meanwhile, only four (4) empirical works found that age had no

significant relationship with the WTP (Abdul Hamid Mar Iman, 2007; Lizawati Abdullah & Thuraiya Mohd, 2022; Nur Syafiqah et al., 2018; Teck Hong, 2011). Therefore, the expected sign of this attribute is heavily influenced by the study area's condition and may have varying impacts.

Locational and neighbourhood variable (LNV)

Table 3: Top five (5) number of variable's utilization for LNV

LNV's attributes	Total codes
Proximity to school	20
Proximity to CBD	18
Proximity to public transport	14
Neighbourhood quality	13
Proximity to shopping mall/ retail shop	10

Table 3 represents the five (5) most popular coded attributes utilized in empirical work out of 20 LNV codes discovered within 35 reviewed articles. There are the attributes of proximity to school, Central Business District (CBD), public transport, neighbourhood quality, and shopping mall/retail shop. The entire LNV's attributes are presented in Figure 2. The sources of LNV are geographical maps, respondent surveys, and site observation.

Proximity to school has been measured either by nearest network distance, Euclidean distance, dichotomous value by evaluating the easy access or existence within a specific distance range, number of schools in sub-district, or based on respondent's preference. The result showed various significant signs. Some of the research separately measured the effect based on the type of the school (e.g., primary, secondary, and high-performance school) (Mohd Faris Dziauddin, 2013, 2014, 2019a, 2019b, 2021; Mohd Faris Dziauddin et al., 2013, 2015). They found that most of the time, the primary and secondary schools gave a positive and negative significant relationship by utilizing network distance as the attribute and rarely to be insignificant. Meanwhile, in all of the cases where the dichotomous value or the number of schools in a sub-district is used, the relationship is found to be positive, which means that when schools exist in the study area, the WTP is also found to be increased (Chin et al., 2004; Nur Syafiqah et al., 2020; Nurul Nazyddah Mat Nazir et al., 2015). Based on the respondent's survey, the choices of proximity to school are a significant factor and classified as a 'need' (Siti Mahfuzah Sarif et al., 2018). Therefore, the attributes of the school could have a considerable effect on the suggested hedonic pricing model.

Proximity to the Central Business District (CBD) has been measured by the closeness in the distance, timesaving, travel time, and accessibility. The significant positive signs are represented by the timesaving for the travelers to the CBD, which indicates that the more time saved, the more WTP for the house (Mohd Faris Dziauddin, 2014; Mohd Faris Dziauddin et al., 2013). They also showcased the negative sign of significance in terms of proximity measured by distance and travel time, where it represented that less distance or time travel would consequently have a higher WTP and proved the standard urban economic theory (Abdul Hamid Mar Iman, 2006; Chin et al., 2004; Mohd Faris Dziauddin, 2014, 2019a, 2021; Mohd Faris Dziauddin et al., 2013; Mohd Faris Dziauddin & Mustika Misran, 2016; Nur Syafiqah et al., 2018). However, a few are found to have significant with a positive sign that represents a higher WTP for the far houses to CBD where it was contradicted by the theory of standard urban economic model by Alonso-Muth-Mills (Mohd Faris Dziauddin, 2019b; Mohd Faris Dziauddin et al., 2015; Nurul Nazyddah Mat Nazir et al., 2015). The accessibility might

contribute to the possibility that the travel distance is less important and would no longer matter (Crompton, 2007). Living far from CBD with good accessibility can provide a decent living quality where people can avoid urban congestion but still enjoy the benefit of CBD (Mariano et al., 2011). Based on factor analysis, Hui Yap, Pui Si, and Skitmore (2019) found that the accessibility to the CBD is significant, with the effect of 0.761-factor loading. Hence, the CBD factor is a significant potential indicator to be implicit in the proposed hedonic pricing model.

Proximity to public transport had been measured in terms of shortest distance (network or Euclidean) unit, the dichotomous value of traveling time within a specific range of time or distance, or by the station's existence within the compound (bus station, taxi stand, LRT station). The result showcased that when the distance-defining proximity is used in the study area, a negative sign of the significant coefficient is regularly found, which means that the far distance to the public transport station will cause the lower WTP of the house (Mohd Faris Dziauddin, 2013; Mohd Faris Dziauddin et al., 2013). Meanwhile, a significant positive sign coefficient is found when a dichotomous value represents the existence of public transport stations within a specific distance range (Mohd Faris Dziauddin, 2019a, 2021; Nurul Nazyddah Mat Nazir et al., 2015; Teck Hong, 2011). However, there are a few situations where the proximity to the bus station was not significant, which might be due to the chosen preference by the respondents from the flood victims who seemed the bus station might not be an issue when facing flood risk or damage (Nur Hafizah Ismail et al., 2016, 2019). In some cases of non-significant, a variation occurred over the geographical area where it was more significant in lower and upper-middle income group areas than those in an affluent residential area, which showed that the possibilities of socio-economic status might influence the preferences of WTP in the case of public transport utilization (Mohd Faris Dziauddin, 2019b). The public transport aspect is indicated as 'important' based on frequency analysis by Hoon Leh et al. (2016) and Siti Mahfuzah Sarif et al. (2018), classified as a 'need' based on significant factor loading. Hence, it can be concluded that the preference for the proximity of public transport was generally found necessary. However, including socio-economic variables might potentially provide a more precise judgment on the importance of public transport facilities in the proposed hedonic pricing model.

Next is the neighbourhood quality attribute, represented in a more diverse and subjective perspective by most reviewed articles. However, this study would comprise the neighbourhood quality by merging the extra facilities, community, and local neighbourhood aspects to represent the neighbourhood quality. The condition of neighbourhood quality is usually characterized using dichotomous values. Based on Chin et al. (2004), neighbourhood quality is measured by being differentiated into two types of attributes: the existence of a swimming pool, gymnasium, tennis court, or community hall as the additional facilities as one attribute (facilities) and the presence of garden, landscaping, and playground as another attribute representing the environment quality to understand the impact of the financial crisis on the WTP. Consequently, the facilities attributes were significantly positive, and this situation was similar to the finding by Suriatini Ismail, Abdul Hamid Mar Iman, et al. (2008), who also had a significantly positive relationship between the existence of facilities and WTP. Unlike the environment quality (the presence of gardens, landscaping, and playground), which was not significant before the financial crisis in 1996 and became positively significant after the financial crisis in 1998 (Chin et al., 2004). Interestingly, according to Mohd Faris Dziauddin (2019a), when the type of facilities are attributed individually based on the actual kind of facilities (gymnasium, swimming pool, tennis court, sauna, and jogging track), he discovered that all are positively significant except for sauna, where it was found not significant. However, a contradicting result is shown by Lizawati Abdullah & Thuraiya Mohd (2022), where the full

facilities properties had a significant negative relationship to the WTP in the condominium market. This situation might be attributed to the financial reason where fully facilities condominiums usually come with higher market prices and, thus, become less interested in the dwellers. On the other hand, Nur Hafizah Ismail et al. (2016) found that the infrastructure facilities are positively significant in urban areas but not significant in rural area when understanding the flood impact on the property. Based on the respondent survey forms, Nurul Nazyddah Mat Nazir et al. (2015) measured the neighbourhood quality by increasing privacy and social interaction, reducing traffic congestion, and the presence of a community centre and discovered a significant positive coefficient. On the other hand, Siti Mahfuzah Sarif et al. (2018) evaluated the aspect of cleanliness in the neighbourhood, which has also represented as a quality, had been significant and classified as 'preference' rather than 'need,' based on the significant factor analysis result. Hui Yap et al. (2019) also discovered a comparable finding where the neighbourhood quality also resulted in a significant factor loading. The aspect of neighbourhood quality in terms of privacy was also measured by Mohd Tawil et al. (2009) and ranked by linguistic value as 'very influencing' using fuzzy weighting. Meanwhile, Hoon Leh et al. (2016) found that a garden/yard is ranked as an important criterion for the house. In conclusion, the element of neighbourhood quality could be varied, and the techniques used in data acquisition might be subject to the area's condition and the research's purpose.

Proximity to shopping malls is measured by proximity in terms of distance unit or by dichotomous value for the existence in a specific range of distance (e.g., within 2 km) or traveling time within a specific duration (e.g., within 20 minutes). The significant result with the positive sign was found in the dichotomous value of distance within 2km, but it was only significant after the financial crisis (Chin et al., 2004). A significant negative sign was regularly found in distance, indicating that the increasing distance to the shopping mall would decrease the WTP for the house (Fah Chang et al., 2019; Mohd Faris Dziauddin, 2019a, 2021). In contrast, Mohd Faris Dziauddin (2013) found a statistically significant but small positive effect (0.051). Based on factor analysis, Siti Mahfuzah Sarif et al. (2018) proximity to the shopping mall was classified as a 'need' with significant factor loading (0.530). Meanwhile, Hoon Leh et al. (2016) labeled as 'critically important' from the frequency analysis. Thus, the shopping mall attribute can be considered as a necessary element to be implicit in the hedonic pricing model.

4. Conclusion

The empirical result of popular attributes has been discovered by classifying the functional variable category into an appropriate use for assisting the hedonic pricing model applications. The identified variables have been discussed to provide a clear justification and minimize the random selection that overruled the location's requirements and, therefore, minimize the potential of misspecification of variables in the hedonic pricing model. As a result, ten (10) attributes are discussed in detail according to BSV and LNV categories. As shown in the result, BSV's variable is the most utilized attribute in the analysis of house preference. The cause might be because it is more straightforward to quantify and acquire. In Malaysia, most of the building's structural information can be gathered from the public authorities (e.g., National Property Information Centre, State or Land Office, Department of Survey and Mapping), private agencies (e.g., developers or real estate companies), or simply from the famous real estate market's websites (e.g., mudah.com, PropertyGuru, iproperty, propertyqueen, etc.).

It is realized that SV's attributes are the minor utilized variables in Malaysian research. Even so, it can aid the understanding of people's preference in WTP for the house, especially when

it comes to the consideration of budget, need, and desire. Indeed, affordability related to budget is the highly influential criterion when buying a house (Mohd Tawil et al., 2009; Nor Suzylah Sohaimi, 2022). Lack of financial capability limits purchasing power and drives the dwellers to let go of a few preferences on the bucket list of the desired house as long as the crucial needs are fulfilled (Thanaraju et al., 2019). However, the information on household financial status, number of family members per house, and household working status fluctuate over time. It is hard to acquire and thus might contribute to omitting those in most case studies. Yet, if the appropriate attribute indicating the household purchasing power can be included, the hedonic pricing model probably demonstrates a precise justification for the influential preference factors. Indeed, the limited use of socio-economics attributes contributes to the lack of understanding of human purchase behaviour.

Based on a glance at the literature reading, the application of the hedonic pricing model is currently acknowledging the monetary impact of natural and environmental resources worldwide (e.g., river, beach, coastal erosion, development planning, etc.), but the diversity of this element in Malaysia's hedonic pricing context of studies is quite limited. Hedonic pricing generally provides a good understanding of the contribution of natural or environmental impact to property value. A holistic development planning with adequate policy establishment for optimizing natural and environmental resources and effects can provide a sustainable quality of life, especially in balancing development and the environment. However, local economic knowledge is limited due to insufficient studies on the potential of empirical pricing models to evaluate Malaysia's environmental values, which requires further attention.

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