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INVESTIGATING THE INFLUENCE OF HOMEBUYERS' SOCIODEMOGRAPHIC FACTORS ON PREFERENCES OF SUSTAINABLE AFFORDABLE HOUSING

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Abstract. Low- and middle-income groups face difficulties in homeownership because of the urbanisation and rising living standards, in which they rely heavily on the government's housing provision. Yet, affordable housing provided in Malaysia has been repeatedly criticised as it is not up to homebuyers' expectations and is not supported to reach sustainable goals. Hence, this research aims to investigate the influence of the sociodemographic background of the homebuyers on their preferences for sustainable affordable housing in Malaysia. The questionnaire was designed and responses were obtained from 316 low- and middle-income homebuyers. Spearman rank correlation and ordinal regression were used to investigate the association between homebuyers' sociodemographic characteristics and their preference for sustainable affordable housing. Spearman correlation analysis revealed that gender, generation, marital status and monthly income were significantly correlated with sustainability criteria. The ordinal regression model reflected that stronger preferences for sustainable affordable housing were shown among female homebuyers, Gen Y and Baby Boomer homebuyers and married ones. The research findings close the gap between users (homebuyers) and the providers (developer/government) in the provision of affordable housing. Developers and the local authorities can provide sustainable affordable housing solutions that suit the needs of different homebuyers.

Keywords: affordable housing, sustainability, sustainable affordable housing, homebuyers' preferences, sociodemographic, housing affordability.

Introduction

Many urban centres have experienced accelerated growth as people migrate to improve their living conditions. The necessary infrastructure to meet the needs of the growing urban population has been inadequate (Mat Lazim, 2020; Oni-Jimoh & Liyanage, 2018), including the demand for housing (Gan et al., 2017). As a result, housing affordability has become a significant challenge, particularly for low-income earners in developed and developing countries (Chan & Adabre, 2019). This affordability issue is exacerbated by the fact that as housing demand increases, so do housing prices. In popular cities like Hong Kong, London and Sydney, this has created significant burdens for low and middle-income groups, who may struggle to find affordable housing options that meet their needs (Galster & Lee, 2020). This has led to a situation where people must spend more on housing, which can limit their ability to invest in other areas of their lives, such as education, healthcare and other essential needs.

Housing unaffordability has forced the low- and middle-income earners to rely heavily on the government's provision of low-cost and affordable housing. Yet, the extent of the defects and housing quality in affordable housing in Malaysia has been repeatedly criticised and lamented in the media and literature (Bilal et al., 2019; Olanrewaju et al., 2022). Besides, according to the third quarter of the year 2021 property market data, 51.7% of newly launched residential units are priced at or below RM 300,000 (National Property Information Centre [NAPIC], 2021). Homebuyers were dissatisfied with their housing (Abdul-Rahman et al., 2014; Musa et al., 2021), indicating that the housing is not supplying desired housing units. Due to the lack of desirable quality housing, there will be an increase in property overhangs, unsold units, and housing abandonment (Olanrewaju & Tan, 2018). Over the past seven

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years, the property overhang has expanded by more than 250% (NAPIC, 2018, 2021), and nearly 75% of the newly launched residential housing was unsold in 2021. Affordable housing accounted for more than 45% of the overhang and unsold units (NAPIC, 2021). It is quite evident that the current state of housing provided by the government fails to meet the requirements of many homebuyers.

When homebuyers' needs are not considered, there is a high likelihood of tension, discontent, neighbourhood instability, property abandonment, and increased crime and transportation costs (Olanrewaju & Wong, 2019). Meanwhile, the lack of appropriate housing not only affects individuals but also puts a strain on the economy and the overall quality of life in the country. Hence, providing more than just basic housing needs, such as comfort, privacy, security, and asset accumulation, is necessary to create a better and more affordable urban environment (Delgado & De Troyer, 2017).

Over the last few years, research on sustainability indicators for affordable housing has been developed by scholars in East Asia and West Africa countries and they are from the professionals' view. Adabre and Chan (2020) developed a model for evaluating affordable housing sustainability from the Ghanaian perspective. Chan and Adabre (2019) investigated the critical success factors for sustainable, affordable housing delivery from affordable housing experts worldwide, while Gan et al. (2017) outlined the key sustainability performance indicators for affordable housing from the perspectives of the Chinese governments, developers and academicians. Except for Ezennia and Hoskara's (2019), and Saidu and Yeom's (2020) study, their research focused on the end users' perspective.

In Malaysia, research on the homebuyer's preferences is on normal residential housing, with the notable exemptions of Afiqah et al. (2020), Md. Yassin et al. (2021), Olanrewaju et al. (2018), Olanrewaju and Wong (2019), and Olanrewaju and Woon (2017), which are related to affordable housing. Affordable housing is designed to satisfy the housing needs of low and middle-income families. Thus, sustainability shall be incorporated into affordable housing to provide a conducive and liveable environment. However, there is little research on the homebuyers' preferences for sustainable affordable housing in the Malaysian context. This study aims to fill the gap by analysing the sociodemographic background of homebuyers and their preferences for sustainable affordable housing in Malaysia. This could help developers and policymakers to build affordable housing that meets the needs of low and middle-income families, leading to a more conducive and liveable environment for all.

1. Literature review

1.1. Affordable housing

Affordable housing is a critical issue in both the international context and in Malaysia specifically. The United Nations has declared housing to be a basic human right, yet millions of people round the world lack access to affordable and adequate housing. Affordable housing is designed to cater to low- to moderate-income families who cannot afford high-cost housing and other basic living expenses. The UN-Habitat (2011) has defined affordable housing as housing that is adequate in terms of location and quality, but not so expensive that prohibits the occupants from meeting other fundamental living necessities.

Many countries use household income to measure housing affordability (Musa et al., 2021). Most experts consider housing affordable if it costs less than 30% or not more than three times of the household annual income. It also refers to a person's financial capacity to finance homeownership. It can also be determined by a person's ability to pay for other essentials with the remainder of their income (Bujang et al., 2015). Meanwhile, many countries have long been plagued by housing affordability and homeownership among the low and middle income households. Even in developed countries, less than one quarter of the housings were deemed affordable (Chan & Adabre, 2019). This is because the growth of housing prices has outpaced the household median income, and thus housing has become less affordable. This is reflected by the situation where the lower income households are overburdened with housing costs and many people are facing shortage of adequate and affordable housing (Plouin, 2019).

The housing unaffordability in Malaysia is also high. Hence, the government has pledged to provide affordable housing, such as 1 Malaysia People Housing Program, Federal Territory Malaysia Home for the low and middle income households, namely the Bottom 40% group (B40) and Middle 40% group (M40) (Ministry of Economic Affairs, 2018). The B40 households are those having a monthly income of RM 4,850 and below, while M40 households have a monthly income of RM 4,851 – RM 10, 959 (Department of Statistics Malaysia [DOSM], 2020). Under the National Affordable Housing Policy, affordable housing can be characterised as housing with a minimum floor area of 900 square feet and a maximum sale price of RM 300,000 (approximately EUR 64,000) (Jabatan Perumahan Negara, 2019). The National House Buyers Association (HBA) suggested that affordable housing need to be located in strategic areas that are highly accessible to public transportation and local amenities, to reduce the overall cost of living for residents.

1.2. The need for sustainable development

The Brundtland Report defines sustainable development as "development that meets present needs without compromising future generations' needs" (Brundtland, 1987). The United Nations (2022) asserts that harmonizing economic growth, social inclusion, and environmental conservation is key to sustainable development, while these interrelated factors are vital to individual and societal well-being. Urbanisation has limited the supply of housing, land, and green spaces, which cannot accommodate

the growing population (Ghazali et al., 2021). Owing to land scarcity, housing affordability remains a significant issue in urban centres. There is a rising housing prices and a limited supply of properties that are both affordable and accessible (Bujang et al., 2015). The low-income individuals might not have many options for renting or purchasing quality housing due to budgetary constraints (Bakhtyar et al., 2012). As a result, many middle-income individuals pay high rent for low-quality housing (Md. Yassin et al., 2021) or they will live in squatter settlements or substandard housing.

High housing costs and poor living conditions will have a detrimental effect on physical and mental health, such as depression, anxiety, and chronic diseases (Park et al., 2015). Living in confined spaces increases the risk of depression, while unprotected living spaces from external intrusion, noise, bugs, and odours can cause discomfort and distress. Anxiety is also linked to housing instability and price spikes (Kim & Yoo, 2021). Notably, mental health issues are emerging in urban areas as the number of people moving to cities increases yearly (Bernama, 2021). Housing is both a physical shelter and mental health source for the occupants (Musa et al., 2021), in which housing suitability, affordability, and quality will affect household housing experiences (Ma, 2018). Housing design should incorporate all necessary elements for creating an interior space that fits the community's lifestyle by recognising their cultural, financial, physiological, psychological preferences (Ibrahim, 2020).

1.3. Sustainable and affordable housing

Based on the previous concepts, affordable housing should meet the housing needs of vulnerable households and consider environmental constraints to endure for future generations. Due to the poor-quality housing offered, the significance of enhancing the inhabitants' quality of life in affordable housing has become a significant concern in recent decades (Delgado & De Troyer, 2017). On the other hand, the demand for affordable housing and the environmental impact of the construction industry is expected to grow in the future, as Mat Lazim (2020) claimed that Malaysia's urban population continues to grow. Housing utilises natural resources, and the massive increase in housing construction has posed a knock-on impact on sustainability, whereas housing is the core of sustainable development (Saliu & Akiomon, 2022).

Additionally, the application of modern technologies in an affordable housing development can maximise these housing's ability to meet the economic and social needs of the households while reducing negative environmental impact without compromising affordability (Moghayedi et al., 2021). Chan and Adabre (2019) point out that the current housing problem will be exacerbated and require substantial financial assistance from the government to recover if price affordability, social wellbeing and environmental sustainability are not considered. Therefore, there is a critical need for housing that is also affordable, sustainable, and liveable. The affordable housing issue is no longer just about the quantity but also about the quality of the house (Musa et al., 2021). If the problem is not dealt with effectively, it might significantly influence the country's economic growth and poverty reduction initiatives (Ghumare et al., 2019).

Furthermore, the 12th Malaysia Plan[1] focuses on promoting sustainable development in various sectors, including affordable housing. It emphasises the importance of providing quality and affordable housing that is sustainable environmentally, economically, and socially. The plan also highlights the need for digitalization and high technology construction methods in the construction sector to improve efficiency and reduce costs. Overall, the 12th Malaysia Plan recognizes the critical role of affordable and sustainable housing in promoting liveability, urban sustainability, and community development (Birruntha, 2022). Hence, thirty-five (35) sustainability criteria for affordable housing established from the literature review and classified into four main criteria: environmental, economic, social, and technological sustainability.

According to the Department of Economic and Social Affairs (2022), 99% of the urban population lives in areas with polluted air, and cities generate more than 70% of greenhouse gases. If housing developers plan, maintain and manage their housing development more efficiently, it can effectively attain environmental sustainability (Md. Yassin et al., 2021). Energy efficiency housing facilities reduce non-renewable resources consumption and carbon dioxide emissions throughout the housing constructions, operations, and maintenance (Adabre & Chan, 2020; AlQahtany, 2020). Additionally, affordable housing development shall incorporate water saving features such as low flow toilets, faucets and also rainwater harvesting system to reduce water consumption and promote sustainable water use. Sustainable Development Goal (SDG) 11 (Target 11.7) aims to provide safe and accessible green areas for all. Open green spaces can promote sustainability and society's well-being by connecting people to nature, yet they are less accessible (Department of Economic and Social Affairs, 2022). Incorporating green spaces into housing development can cool the surroundings and reduce surface run-offs, lowering the risk of flooding (Golubchikov & Badyina, 2012). Additionally, disaster-resilient housing can help protect vulnerable communities from the impact of natural disasters (Gan et al., 2017). This aligns with the United Nations Sustainable Development Goals, particularly SDG 11, which focuses on making cities and human settlements inclusive, safe, resilient, and sustainable. Thus, environmental sustainability in affordable housing can aid in preserving biodiversity, conserving natural resources,

[1] Is a five-year development plan (2021–2025) with the aim to achieve "a prosperous, inclusive, sustainable Malaysia", by focusing on economic empowerment, environmental sustainability, and social reengineering.

reducing waste and pollution, and mitigating and adapting to climate change (Oyebanji et al., 2017).

The economic sustainability of affordable housing to homebuyers is important as it can have a significant impact on their financial well-being. Affordable housing can provide an opportunity for low- to moderate-income families to own a home and build wealth over time through homeownership. This, in turn, can contribute to their overall economic stability and help them achieve financial independence (Enterprise Community Partners, 2014). Lower income households have more debt due to the increased housing expenditures and other fundamental consumption goods such as health and education. As a result, homeownership is no longer affordable (Plouin, 2019). Many countries recognise low household income as a leading cause of the shelter-cost burden, affecting housing affordability in purchasing power and mortgage eligibility (Liu & Ong, 2021). Therefore, housing prices and rental costs shall be affordable with income. The government should provide financial assistance in the form of subsidies or lower interest rates which can make affordable housing more accessible to homebuyers (Oyebanji et al., 2017). Abdul Hamid et al. (2018) suggested that homebuyers may afford sustainable homes while meeting other essential living needs with government assistance. AlQahtany (2020) also emphasises the need for thoughtful planning to avoid future renovations and reduces lifecycle and maintenance cost, leading to additional cost savings. In other words, an economic sustainable housing can provide them with a stable and affordable housing option and reduce financial burden of the homebuyers.

As for social sustainability, housing provides a sense of security and strengthens local communities rather than simply providing shelter. However, the rapid development of affordable housing does not guarantee the community's quality of life (Kamaruzzaman & Azmal, 2019). Nevertheless, housing quality and household contentment are critical indicators of adequate housing (Abdul Hamid et al., 2018; Adabre & Chan, 2020; Chan & Adabre, 2019). As established under SDG 11 (Target 11.1), affordable and adequate housing shall be accessible to all. Gan et al. (2017) assert that affordable housing distribution should be fair and equitable. A liveable housing area refers to a safe and secure environment that allows for social interaction, spiritual development (Abdul Hamid et al., 2018), and accessible local amenities that meet the community's needs (Oyebanji et al., 2017). Mobility and connectivity are improved with a well-planned and effective public transportation system, which could reduce pollution and congestion while eradicating poverty (Department of Economic and Social Affairs, 2022). Unfortunately, most affordable housing is located far from cities, which increases commuting time and fuel costs. Those working far from home must use their private vehicles due to poor public transport (Olanrewaju & Woon, 2017). Md. Yassin et al. (2021) state that increasing transportation costs would result in unsustainable affordable housing. Besides, good quality housing fosters a sense of community and belonging (Abdul Hamid et al., 2018), such as housing design that reflects local culture and aesthetics (Gan et al., 2017). Housing quality can be evaluated on indoor air, thermal, visual, and acoustic comfort. Meanwhile, an adaptable housing design could fulfil households with different needs accordingly to their life stages, while a disabled-friendly housing design allows those with limited mobility to live comfortably (AlQahtany, 2020). When affordable housing is sustainable, it can support healthy, vibrant, and strong communities (Oyebanji et al., 2017).

Technological sustainability is the deployment of innovations and modern technologies for affordable housing, which can promote efficiency (Saidu & Yeom, 2020). The sector has limited use of innovative technologies to reduce inefficiencies in delivering affordable housing. Traditional design and construction methods have hampered the sustainability and cost-effectiveness of affordable housing units (Moghayedi et al., 2021). However, Abdul Hamid et al. (2018) argue that highly industrialised building systems are not the best option for sustainable, affordable housing. Golubchikov and Badyina (2012) explain that locally available traditional materials (e.g., bamboo or timber) have a lower environmental impact due to their lower embodied energy. It can also reduce the overall construction cost of housing (Abdul Hamid et al., 2018). SDG 11 (Target 11.c) recognises the need to use localised building materials, especially in less developed countries. Adabre and Chan (2020) suggest that sustainability and housing quality can be achieved using suitable construction technologies and appropriate building materials. Furthermore, technology could help improve the environment by minimising pollution. For instance, a smart mobile system can promote walkability in cities and help users avoid traffic congestion. A household can enjoy automated and enhanced service through a smart home system (Kim et al., 2020). For example, an elderly assisted system facilitates the elderly to live independently at home (Koh & Mustapa, 2021). Occupants also can enjoy energy efficiency savings from smart homes (Kim et al., 2020), which will lead to a happier community with sustainable, affordable smart housing (Mohamad et al., 2020).

1.4. Sociodemographic of home buyers and housing preferences

The critical decision-making process is based on several sociodemographic variables (Liu et al., 2018; Tung et al., 2017). Determinants such as income level or racial discrimination in housing can significantly restrict an individual's home choices (Tung et al., 2017). Boumeester (2011) further claims that changes in household composition, employment, and income would play a part in household decisions entering the housing market. Preferences for housing of homebuyers are influenced by marital status, age and number of households, educational level, and cultural value (Kam et al., 2018).

Numerous studies have taken place to understand the needs and preferences of homebuyers regarding housing to

ensure their satisfaction level remains acceptable (Afiqah et al., 2020; Olanrewaju & Woon, 2017). However, research regarding associations between sociodemographic variables and housing preferences is limited. Meanwhile, Moghimi et al. (2016) assert that prospective homebuyers' or users' requirements and needs are not adequately considered in affordable housing projects. It is critical to consider homebuyers' or users' preferences when designing affordable housing options that improve quality of life. Homebuyers are unlikely to be satisfied with housing options that do not meet their requirements while prevailing housing issues remain unresolved.

When purchasing a house, Majid et al. (2012) find that homebuyers' demographics, particularly employment, gender, and marital status, substantially impacted property criteria. Similarly, in America, gender, ethnicity, income level, education level, and age influenced residential preferences (Li et al., 2019). Earlier studies have shown that gender roles and housing preferences are interrelated (Li et al., 2019; Mridha, 2020; Sreen et al., 2018). Saudi Arabia scholars also discover that gender will impact the purchasing decision for residential property (Opoku & Abdul-Muhmin, 2010). Females' housing and neighbourhood preferences may differ from males' due to their obligations for childcare, eldercare, and other household duties. For instance, females prioritised more on convenience shopping, neighbourhood safety, accessibility to friends and family, and public transportation when selecting a new home than males (Mridha, 2020). Li et al. (2019) report that females had a greater preference for where they wanted to live compared to males. Besides, due to more significant female concern for the environment, they will engage in environmentally friendly activities, although it is inconvenient for time, money, or self-efficacy (Sreen et al., 2018).

Moreover, basic living requirements can be met more effortlessly with a higher household income (Li et al., 2018), such as owning a home (Fakere & Ayoola, 2018) and choosing sustainable housing options to fulfil their comfort needs (Li et al., 2018). Likewise, higher-income homebuyers were more willing to pay more money for green buildings (Myeda et al., 2016). On the other hand, lower income households may prioritise affordability over sustainability. Likewise, transportation affordability is also impacted by income level (Chan & Adabre, 2019), with lower-income individuals placing more importance on walkable and accessible communities, while higher-income individuals prefer car-friendly neighbourhoods (Li et al., 2019). Higher-income individuals are also more likely to own vehicles and use them for everyday commuting, which may influence their decisions regarding the convenience of shopping and transportation systems when deciding where to live (Aditjandra et al., 2012).

An individual's education level can be correlated with their income level. Research has consistently shown that higher levels of education are associated with higher earning potential and better job opportunities (Salleh et al., 2014). For example, college graduates have a better chance of earning more than high school graduates (Lindstrom, 2019). Higher education levels can also influence an individual's lifestyle and living conditions. For example, research suggests that individuals with higher education levels are more likely to seek out affordable and high-quality housing options (Li et al., 2019). At the same time, they may also be more likely to invest in more expensive housing options, such as homes in desirable neighbourhoods or upscale housing (Hassan et al., 2021). Overall, individuals with higher education levels tend to report higher levels of life satisfaction and happiness, which may be partially explained by their ability to afford higher quality living conditions and lifestyle choices (Tan, 2012).

According to Mridha (2020), marital status can influence the traits of a household, such as headship, migration, and family formation. Single homebuyers have different affordability levels than households with families (Salleh et al., 2014). Individuals with families usually wish for a suitable house for their families (Fakere & Ayoola, 2018). People who are married and those who are not may have different levels of stress in their lives. Married people have a higher income than unmarried people, especially in multi-earner households, which are more financially stable. It could be due to increased women's labour force participation (Lindstrom, 2019).

Homebuyers are classified into three groups, namely Baby Boomers, Generation X and Generation Y, while different generations do not all behave the same way. Various factors influence a generation's behaviour and how they interact with the world (Hoxha & Zeqiraj, 2019). As social media has spread positive attitudes toward green products, there is an increased preference for sustainable housing among younger generations who are exposed to social media (Zhang et al., 2018). Li et al. (2019) found that the older generation would prefer walkable and accessible communities and a car-friendly and safe neighbourhood. Individuals' lifestyles and activities tend to gravitate more toward the home as they age. Thus, a neighbourhood may become a more prominent feature of one's environment when mobility declines with age (Mridha, 2020). According to Tung and Comeau's (2014) generation classification, Baby Boomers were born between 1943 and 1960, Generation X between 1961 and 1982 and Generation Y between 1983 and 2004. When Baby Boomers bought their first home, the price was primarily considered. Price preference and average house size were expanded by Generation X, who had a more liberal view of the market. The amount of time needed to pay for a house has changed due to changing lifestyle features and affordability (Hoxha & Zeqiraj, 2019). Furthermore, Generation Y values work-life balance and a healthy lifestyle, preferring to spend their free time with family and friends and participating in sports and other recreational activities (Bujang et al., 2015).

Different ethnic and racial groups had varying housing expenses due to their socioeconomic status, influencing housing affordability. For instance, in the United States, Hispanic and black migrant households tend to live in higher-density housing than white and non-white

Native Americans because of their lower socioeconomic status. Hispanics and Blacks were found to benefit less from mortgages and housing than Whites (Latimaha et al., 2019). Small proportions of Indian ethnic group tenants face rent defaults due to their socioeconomic problems resulting from poor income (Salleh et al., 2014). Latimaha et al. (2019) also found that in Malaysia, different ethnic groups have different mortgage and rental expenditure patterns, which the Chinese and Indians spend more on mortgages than Malays. Besides, according to Aminnuddin's (2020) study, Malays were more likely than Chinese not to want diverse neighbours. It suggests that a household's housing preferences may vary depending on ethnicity.

Khan et al. (2020) indicate that identifying early purchasers and their characteristics promotes market adoption of sustainable products. Low- and middle-income countries face increasing challenges in environmental preservation and public health promotion as industrialisation and urbanisation progress (Shi, 2022). Low awareness and lack of knowledge is a significant hindrance for homebuyers in Malaysia in developing countries to purchasing sustainable housing (Soon & Ahmad, 2015). In contrast, sustainable housing has undeniable advantages for home users. However, to enhance the sustainability and performance of affordable housing delivery, a deeper understanding of Malaysian homebuyers' perceptions and preferences for property purchases is needed (Yap et al., 2019). Musa et al. (2021) suggest that housing should be based on what most homebuyers are looking for. Homebuyers are increasingly looking for properties with eco-friendly features, including high energy efficiency, rainwater harvesting systems, and greywater recycling systems (Kam et al., 2018). Malaysian homebuyers prefer their houses near local amenities, better soundproofing, and larger green space (Myeda et al., 2016). Parks, trees and green spaces provide the residents with recreational opportunities and aesthetic enjoyment (Yap et al., 2019).

Past researchers have shown that an individual's sociodemographic background can influence their preferences in housing. Hence, this study investigates the associations between sustainable, affordable housing preferences and sociodemographic variables. The sociodemographic factors assessed in this study are gender, marital status, income level, generation, education level and race. By knowing the associations between sociodemographic factors and the sustainable, affordable housing criteria, homebuyers' sustainable, affordable housing preferences could be predicted.

2. Methods

This study utilised a quantitative research method to analyse the influence of sociodemographic backgrounds of the homebuyers on their perception of sustainable affordable housing criteria. Due to the primary focus of this research is to gather perspectives from homebuyers, the target group comprised the B40 and M40 Malaysians. These individuals in the Klang Valley area were requested to participate and respond to a questionnaire regarding the sustainability criteria for affordable housing. Individuals from the Klang Valley (which includes Kuala Lumpur, Selangor, and Putrajaya) were chosen for this study because it has nearly 26% of the country's total population (DOSM, 2021) and over 46% of the country's residential units were constructed in this area (NAPIC, 2021). This study used convenient sampling to collect primary data, as there was insufficient information available on the population size. While convenient sampling may not be representative of the entire population, the use of a large sample size can increase the representativeness of the findings (Sekaran & Bougie, 2010). To determine the sample size for the study, the Cochran formula was used, and a sample size of 246 responses was determined. This sample size was deemed adequate to achieve reliable results.

Two preliminary checks were made before actual data collection. First, a pre-test was conducted with two academician and five construction professionals to ensure the content validity of the questionnaire. Then, the questionnaire survey was pilot tested on 30 respondents to detect and fix any issues in the questionnaire. The questionnaire is divided into two sections. Section A consists of demographic information, such as gender, age group, ethnicity, education level, marital status, intention to purchase affordable housing, the maximum price range for affordable housing, etc. Section B requested the respondents to rate the importance of each of the 35 sustainability criteria for affordable housing on a five-point Likert scale, ranging from 1 (not important) to 5 (extremely important). The survey was designed in Google form and distributed from 17th September 2021 to 11th December 2021 via social media.

Statistical Package for Social Sciences was used to analyse the collected data. Descriptive statistical analysis (frequencies) was used to report the sociodemographic backgrounds of the respondents. Next, Spearman's correlation coefficient was used to assess the strength and direction of the two variables. It tests the correlations between the six sociodemographic variables (gender, ethnicity, generation, educated level, marital status and monthly income) and the thirty-five sustainability criteria for affordable housing. Some independent variables (generation and marital status) were converted to variables with fewer categories to ensure adequate responses in each category. The correlation is significant at a 0.05 level of significance.

Following that, ordinal logistic regression was used when the dependent variable is ordinal and the researcher wants to assess the influence of continuous or categorical independent variables on the dependent variable (O'Connell, 2006). For example, an ordinal regression would be used to determine further the contribution of sociodemographic variables to the importance of sustainability criteria if there was a significant correlation. From the parameter estimates results, if the p-value of the independent variable (sociodemographic) was larger than 0.05,

the independent variable does not affect the dependent variable (perceived importance of sustainability criteria). A positive regression coefficient β shows a positive association between the independent/explanatory variable and ordinal dependent variable; vice versa. Positive β also means that the independent variable has greater odds of moving to a higher ordered category.

3. Results

3.1. Sociodemographic background of the respondents

316 responses were received and Table 1 summarizes the sociodemographic background of the respondents. 49.7% of the respondents were male and 50.3% were female. Chinese made up the majority of the respondents at 40.2%, then Indians (32.9%), followed by Malay (26.9%). Most respondents were aged between 18–29 years old, accounting for 62.7% of the total respondents who participated. The lowest was 0.6% for respondents aged 61 years old and above. The majority of the respondents (68.4%) have completed Bachelor's degree. This is followed by Master's degree (18.7%) and diploma (7.3%). Whereas a minority of respondents (1.9%) have completed Foundation / A-Level / STPM / UEC, others was at 1.6%, while 1.3% and 0.9% were educated up to secondary school and doctorate level, respectively. Around 72.2% of the respondents were single, whereas 26.9% were married and 0.9% were divorced. Moreover, more than half of the respondents (57.3%) were having a monthly income of RM 4,850 and below and the remaining (42.7%) were earning a monthly income of RM4,851 to RM10,959.

Table 1. Sociodemographic backgrounds of respondents

Demographic information	Frequencies (n = 316)	Percentage (%)
Gender		
Male	157	49.7
Female	159	50.3
Ethnicity		
Malay	85	26.9
Chinese	127	40.2
Indian	104	32.9
Age		
18 years old to 29 years old	198	62.7
30 years old to 38 years old	67	21.2
39 years old to 49 years old	33	10.4
50 years old to 60 years old	16	5.1
61 years old and above	2	0.6
Education		
Secondary School	4	1.3
Foundation / A-Level / STPM / UEC	6	1.9
Diploma	23	7.3
Bachelor's Degree	216	68.4
Master's Degree	59	18.7
Doctorate	3	0.9
Others	5	1.6
Marital status		
Single	228	72.2
Married (without children)	15	4.7
Married (with children)	70	22.2
Divorced (without children)	1	0.3
Divorced (with children)	2	0.6
Income level		
RM 4,850 and below (B40)	181	57.3
RM4,851 to RM10,959 (M40)	135	42.7

3.2. Relationship between sustainability criteria and sociodemographic of homebuyers

Table 2 demonstrates a significant relationship between sociodemographic variables and sustainability criteria. Negligible or weak correlations were obtained. However, the regression analysis further assessed the correlations that are significant at the 0.05 significance level in the Spearman Correlation analysis results. Four of the six sociodemographic variables significantly correlated with the sustainable affordable housing criteria, namely Gender, Generation, Marital Status and Monthly Income.

From Table 2, it appears that gender, generation, marital status and monthly income are significant factors that influence preferences for certain sustainability features in affordable housing. For example, Gender was positively associated with rainwater harvesting system (0.043), accessibility to public transport (0.034), and the use of sustainable or regional building materials (0.024). Besides, Generation was positively associated with visual comfort (0.021), acoustic comfort (0.045), community participation (0.013), safety and security (0.025), cultural and historical conservation (0.025), incorporation of smart or green features (0.010), use of sustainable or regional building materials (0.002) and use of innovative construction techniques and methods (0.006).

Furthermore, Marital status was positively associated with appropriate density (0.044), interest rate (0.042), reduced life-cycle cost (0.017), desirability - market value of a building (0.031), ease of maintenance (0.008), time effectiveness (0.013), accessibility to public transport (0.002), accessibility to local amenities (0.001), adaptability (0.021), visual comfort (0.014), community participation (0.006), cultural and historical conservation (0.007), social equity (0.024), cater for people with disabilities and/or mobility impairments (0.027), incorporation of smart or green features (0.020), and use of sustainable or regional building materials (0.010). In addition, Income level was positively associated with accessibility to public transport (0.032), accessibility to local amenities (0.012), indoor air quality (0.037), visual comfort (0.024), and use of sustainable or regional building materials (0.040).

Table 2. Summary of correlation coefficient test between sustainability criteria and sociodemographic

Code	Sustainability criteria	Gender	Ethnicity	Generation	Educated level	Marital status	Monthly income
Environmental aspect							
A1	Energy efficiency	0.009	0.086	0.091	0.026	0.105	0.106
A2	Availability and quality of open green spaces	0.036	0.076	0.101	–0.022	0.086	0.092
A3	Waste management and disposal	0.057	0.035	0.053	0.009	0.009	0.039
A4	Water efficiency	0.100	0.033	0.039	0.014	0.025	0.044
A5	Appropriate density	0.093	0.078	0.108	–0.040	**0.114***	0.057
A6	Disaster resistance	0.069	–0.043	0.048	–0.062	0.040	0.003
A7	Rainwater harvesting system	**0.114***	0.034	0.047	–0.017	0.017	0.103
Economical aspect							
B1	Housing and rental price affordability	0.066	0.04	0.026	–0.017	0.091	0.008
B2	Interest rate	–0.013	0.015	0.011	–0.047	**0.114***	0.056
B3	Mortgage availability	0.013	0.024	0.022	–0.016	0.084	0.028
B4	Housing subsidy	0.021	0.052	–0.016	0.003	0.066	0.051
B5	Reduced life-cycle cost	0.037	0.061	0.011	0.018	**0.135***	0.046
B6	Desirability - market value of a building	0.009	0.047	0.013	–0.039	**0.121***	0.036
B7	Ease of maintenance	0.016	0.077	0.027	0.018	**0.149****	0.030
B8	Time effectiveness	0.028	–0.008	0.014	0.044	**0.140***	0.020
Social aspect							
C1	Accessibility to public transport	**0.120***	0.005	0.099	0.070	**0.170****	**0.121***
C2	Accessibility to local amenities	0.073	0.057	0.093	0.026	**0.184****	**0.142***
C3	Adaptability	0.076	0.035	0.061	–0.032	**0.129***	0.071
C4	Indoor air quality	0.065	–0.014	0.110	0.043	0.105	**0.118***
C5	Thermal comfort	–0.001	0.07	0.070	0.019	0.057	0.064
C6	Visual comfort	0.094	0.027	**0.130***	0.005	**0.139***	**0.127***
C7	Acoustic comfort	0.050	0.023	**0.113***	0.006	0.071	0.050
C8	Community participation	0.049	–0.017	**0.140***	0.006	**0.155****	0.099
C9	Infrastructure provision	0.081	–0.026	0.086	–0.002	0.091	0.060
C10	Neighbourhood environment	0.058	–0.009	0.045	0.040	0.075	0.034
C11	Physical attributes of the house	0.060	0.004	–0.024	–0.001	–0.004	0.012
C12	Housing locations	0.010	0.041	0.008	0.012	–0.001	–0.029
C13	Safety and security	0.056	0.035	**0.126***	0.027	0.088	0.079
C14	Cultural and historical conservation	0.093	0.053	**0.126***	–0.009	**0.151****	0.079
C15	Social equity	0.076	–0.01	0.092	0.058	**0.127***	0.056
C16	Security of tenure	0.057	–0.065	0.010	0.031	0.038	–0.068
C17	Cater for people with disabilities and/or mobility impairments	0.040	–0.004	0.092	0.085	**0.124***	0.027
Technological aspect							
D1	Incorporation of smart or green features	0.025	0.062	**0.144***	–0.083	**0.131***	0.071
D2	Use of sustainable or regional building materials	**0.127***	0.105	**0.178****	–0.025	**0.146****	**0.116***
D3	Use of innovative construction techniques and methods	0.060	0.084	**0.154****	–0.015	0.109	0.098

Note: * Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

3.3. Ordinal regression model for sustainability affordable housing criteria among homebuyers with different sociodemographic

Homebuyers' sociodemographic background can be used to predict homebuyers' sustainable affordable housing preferences with ordinal logistic regression. An ordinal dependent variable (DV) was required, whereas the independent variables (IV) can be continuous, ordinal or categorical. In this study, the DV is the sustainable affordable housing criteria with an ordinal outcome with five levels; and the IVs are the sociodemographic background, namely gender, ethnicity, generation, education level, marital status, monthly income, as listed in Table 3.

Table 3. List of the dependent and independent variables

Variables	
Response/Dependent variable (DV)	
Sustainability criteria	1 = 'not important'
	2 = 'less important'
	3 = 'moderately important'
	4 = 'important'
	5 = 'most important'
Predictor/Independent variable (IV)	
Gender	0 = Male
	1 = Female (Ref.)
Ethnicity	0 = Malay
	1 = Chinese
	2 = Indian
Generation	0 = Gen Y
	1 = Gen X and Baby Boomers (Ref.)
Educated level	0 = Low
	1 = Medium
	2 = High
Marital status	0 = Single
	1 = Married (Ref.)
Monthly income	0 = RM 4,850 and below
	1 = RM4,851 to RM10,959 (Ref.)

The correlated variables were entered into the model for their respective sustainability criteria. Three of the four significantly associated independent variables (gender, generation, marital status, monthly income) were statistically significant, as shown in Table 4. It shows no multicollinearity issue within the variables as detected using VIF. The regression results revealed that marital status is a significant explanatory variable in most sustainability affordable housing criteria.

As tabulated in the ordinal logistic regression results in Table 4, gender was statistically significant variable in predicting homebuyers' preferences on sustainability criteria for affordable housing. Male and female have distinct perception on rainwater harvesting system (A7), accessibility to public transport (C1) and the use of sustainable or regional building material (D2). Female has higher odds to favour these sustainability criteria as compared to male homebuyer.

In addition, from Table 4, it is observed that marital status was statistically significant variable in predicting homebuyers' preferences on sustainability criteria for affordable housing. As compared to single homebuyers, married homebuyers have a higher probability of appreciating the sustainability criteria for affordable housing, namely the low interest rate (B2), reduced lifecycle cost (B5), desirability - the market value of the building (B6), ease of maintenance (B7), time effectiveness (B8), accessibility to public transport (C1), accessibility to local amenities (C2),

Table 4. Final model results as determined by ordinal regression

Model No	Sustainability criteria (DV)	Variables (IV)	B	Std. Error	Sig.	Exp(B)	VIF
1	A7	Gender = Male	–0.423	0.2092	0.043*	0.655	1.000
2	B2	Marital status = Single	–0.511	0.2539	0.044*	0.600	1.000
3	B5	Marital status = Single	–0.595	0.2491	0.017*	0.552	1.000
4	B6	Marital status = Single	–0.528	0.2444	0.031*	0.590	1.000
5	B7	Marital status = Single	–0.643	0.2451	0.009*	0.526	1.000
6	B8	Marital status = Single	–0.601	0.2433	0.014*	0.549	1.000
7	C1	Gender = Male	–0.462	0.2088	0.027*	0.630	1.000
		Marital status = Single	–0.588	0.2641	0.026*	0.556	1.294
8	C2	Marital status = Single	–0.637	0.2658	0.017*	0.529	1.000
9	C3	Marital status = Single	–0.519	0.2293	0.024*	0.595	1.000
10	C13	Generation = Gen Y	–0.610	0.2819	0.030*	0.543	1.000
11	C15	Marital status = Single	–0.497	0.2279	0.029*	0.608	1.000
12	C17	Marital status = Single	–0.505	0.2329	0.030*	0.603	1.000
13	D2	Gender = Male	–0.473	0.2081	0.023*	0.623	1.000
		Generation = Gen Y	–0.709	0.3318	0.033*	0.492	1.364
14	D3	Generation = Gen Y	–0.753	0.2804	0.007*	0.471	1.000

Note: * Statistically significant at $p < 0.05$ level.

adaptability (C3), social equity (C15), and cater for people with disabilities and/or mobility impairments (C17).

Besides, generation was also a statistically significant variable in predicting homebuyers' preferences on sustainability criteria for affordable housing. There is a greater tendency for older generations (Gen X and Baby Boomers) to prefer affordable housing with better safety and security (C13), use of sustainable or regional building material (D2) and the use of innovative construction techniques and methods (D3) than the younger generations (Gen Y).

4. Discussion

This study found out that female homebuyers are likely to perceive sustainable affordable housing criteria positively. The findings are consistent with previous studies, showing that females in India are more concerned about environmental issues and sustainability compared to male homebuyers, and this can translate into their preferences for affordable housing (Sreen et al., 2018). According to Sreen et al. (2018), the majority of females in India were housewives and that they were spending more time at home. Similarly, DOSM (2022) reported that majority of the Malaysian female were less likely than males to get a job. If they did get a job, they were more likely to work part time. Meanwhile, research conducted by Aloul et al. (2018) and Abdullah et al. (2021) suggests that females have a higher tendency to use public transportation instead of driving. This observation is consistent with findings from Pakistan, where Abdullah et al. (2021) noted that societal and cultural factors often discourage females from driving. Aloul et al. (2018) argue that ensuring women's access to public transportation is vital for their full participation in the economy, society, and politics. Consequently, females place greater importance on the accessibility of public transportation when considering housing options. Furthermore, females often have lower income and more likely to face financial challenges when it comes to accessing housing (UNICEF, 2020). As such, affordable housing that use regional building materials can be advantageous, as it helps reduce dependency on expensive imported building materials, making it a long term financially sustainable option (Syed Jamaludin et al., 2018).

Besides, the result revealed that the older generations (Gen X and Baby Boomers) placed higher importance on sustainable features in affordable housing. This could be because as people age, they need more comfortable living environments due to the accumulation of material wealth and the gradual decline in physical fitness. Therefore, they will be more concerned about the items affecting their health (Li et al., 2018). Meanwhile, Mridha (2020) opines that older person tends to spend more time and their activities in their immediate surroundings, such as home or neighbourhood. Thus, older generations place higher concern on the safety of their living environment to reduce their risk of injuries and ensure safe mobility.

However, Gen Y is less prioritised on the sustainability features for affordable housing from the result obtained. The findings contradicted with Kam et al. (2018) who claimed that Generation Y has higher green consciousness and would prefer to opt for sustainable houses. This inconsistency could be explained by the perception of affordable housing as a transition or temporary home for Gen Y (Economic Planning Unit, 2015). Furthermore, many Gen Y have just started working, and their income barely could afford a house. Additionally, Bujang et al. (2015) further explain that housing prices have been rising at a faster rate than wages, making it challenging for young people to keep up. Bujang et al. (2015) emphasises that most Gen Ys have other financial obligations, such as credit card and car loans, that they need to prioritise before considering buying a house. Given these circumstances, the desire to own or purchase housing may be lower among Gen Y individuals. Li et al. (2018) argue that sustainable housing is often perceived as expensive, which further contributes to the reduced emphasis on sustainability features by Gen Y individuals in affordable housing.

The findings also showed that married households placed higher importance on the economical sustainability of affordable housing. For low- and middle-income homebuyers, married couples are more likely to purchase a home as compared to singles, due to the transient nature of unmarried household's life (Grinstein-Weiss et al., 2011). Therefore, mortgage loan with lower interest rate could reduce their cost of borrowings. In addition, housings that could reduce lifecycle cost were found to be more preferred by married households. The cost of operating a home is currently increasing and this trend appears certain to continue (Olanrewaju & Tan, 2018). Li et al. (2018) discovered that the operational costs of larger families were higher, and so they will choose sustainable housing to reduce those expenditures. Furthermore, prior research implied that home ownership does offer a means of accumulating wealth and assets. Married homebuyers placed greater importance level on the desirability of housing (Grinstein-Weiss et al., 2011), with the potential to sell off as for monetary supplement.

Moreover, marital status was found to be a significant predictor of the importance level for certain social sustainability criteria in this research. This is because people who have families are more likely to want to live in a home that is ideal for their family members (Fakere & Ayoola, 2018). According to Mridha (2020), people who are married tend to be more concerned with the quality of their neighbourhood than those who are single. This is due to married people tend to have children and are concerned about the accessibility to public transport and local amenities such as school, recreation opportunities etc.

Besides, housings that are adaptability and can cater for disabilities were found to be more important to married households, as compared to singles. Adaptation and expansion are common issues for people who live in affordable housing because many homes do not have enough room for everyone in a family or enough storage space (Olanrewaju & Tan, 2018). Three generations living together are common in Malaysian families (The City &

Country Team, 2022). Children and the elderly alike can benefit from flexible housing configurations that can be tailored to their specific needs. The City & Country Team (2022) also suggested to include features that encourage independent living, such as wheelchair ramps and sliding doors for better accessibility.

Overall, this research investigated the influence of homebuyers' sociodemographic on their preferences for sustainability features of affordable housing. The results shed some light on the readiness of Malaysian low (B40) and middle income (M40) homebuyers for sustainable features in affordable housing. The findings corresponded to the government's goal of providing quality and adequate housing for all. Therefore, it serves as evidence for governments or policymakers to incorporate sustainability concepts in affordable housing that could minimise housing expenses, enhance social integration and facilitate sustainability. In addition, the findings of this research can serve as a valuable planning tool for policymakers, enabling them to improve the quality and affordability of housing for low- and middle-income individuals. By shifting from a traditional focus on price, income, and cost to a perspective that emphasises sustainability, quality, and affordability, the housing industry can better meet the needs and aspirations of the population. Furthermore, it increases the awareness among the public especially the property and construction industry about the importance of incorporating sustainability and smart aspects into affordable housings. It emphasises that affordability should not be the sole criterion, but rather that other factors, such as sustainability and smart features, should be considered to promote the development of affordable housing in the future. Ultimately, this research contributes to the achievement of Sustainable Development Goal 11, "to make cities and human settlements inclusive, safe, resilient, and sustainable", in which it could harmonise economic, social, and cultural equity with environmental sustainability to create more liveable cities.

Despite bringing fresh insights to sustainable affordable housing development, other researchers could address some weaknesses in the future. First, the results are not be generalisable as a non-probability sampling method was adopted. The sample population was also restricted to the homebuyers of the Klang Valley areas in Malaysia. Thus, it is suggested for future research to use probability sampling (e.g., random sampling) for a more representative sample and generalise findings to the population, or to replicate current research in other states or countries to generalise the finding on sustainable affordable housing. Furthermore, the findings have put forward that homebuyers' preferences on sustainability criteria for affordable housing are influenced by their sociodemographic preferences. Since all sociodemographic variables (e.g. family size, previous homeownership experience) have not yet been assessed in this research, there is an opportunity for further research by examining these variables that may affect housing preferences.

Conclusions

Although the awareness of sustainability in Malaysia's housing industry is emerging, there is a gap between existing affordable housing policies and the preferences of end-users (homebuyers) regarding sustainable solutions. Besides, previous research showed that homebuyers with different sociodemographic characteristics have different housing preferences. This study aimed to assess the sociodemographic characteristics that influence the preferences of sustainability features in affordable housing. A list of 35 sustainability criteria for affordable housing were established through a literature review, which were categorised into the environment, economic, social and technological criteria. Among the 35 sustainability criteria, it comprises of 7 environmental sustainability sub-criteria, 8 economical sustainability sub-criteria, 17 social sustainability sub-criteria and 3 technological sustainability sub-criteria.

A questionnaire survey was designed to collect quantitative data from 316 homebuyers in Klang Valley, Malaysia. Spearman correlation and ordinal regression were used to investigate the association between homebuyers' sociodemographic characteristics and their preference for sustainable affordable housing. Spearman correlation analysis showed that gender, generation, marital status and income level were correlated with the sustainability criteria. In addition, these sociodemographic variables were included in the ordinal regression model to predict which segments of homebuyers place higher importance on sustainability criteria. The findings reflected that females, married households and the older homebuyers expressed higher concern on the sustainability of affordable housing.

This study contributed to understanding homebuyers' preferences for sustainable affordable housing. The findings have important implications for developers, governments and policymakers in formulating affordable housing policies that cater to the needs and preferences of different sociodemographic groups, such as the preferences of youngsters, and provide them with relevant affordable housing initiatives. By incorporating sustainable housing design solutions that align with the preferences of specific sociodemographic groups, policymakers and developers can effectively meet the needs of end-users. By utilizing the research findings in practice, policymakers can influence public policy and affect the quality of life by promoting the development of sustainable housing in Malaysia. This can contribute to creating more livable and resilient communities. Ultimately, this approach not only improves residents' well-being but also enhances the overall sustainability of the built environment. In addition, the research highlights the need for further research on sustainability for affordable housing in Malaysia which emphasise on the innovative construction materials, energy efficient technologies, affordable financing options and community driven housing initiatives. However, this study may have a limited analysis of homebuyers' sociodemographic background. Hence, future research must assess a broader range of sociodemographic variables for more insightful implications.

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Author contributions

LX Lai conceptualized and designed the study, collected and analysed the data, and wrote the manuscript. PF Wong contributed to the conceptualization and design of the study, and provided critical feedback on the manuscript. FYY Yong provided comments on the writing of the manuscript. All authors read and approved the final manuscript.

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The authors have no competing interests to declare that are relevant to the content of this article.

References

Abdul Hamid, S., Hidayah Syed Jamaludin, S., & Mahayuddin, S. (2018). Achieving sustainable affordable housing scheme from the perspective of multi eco-system. *IOP Conference Series: Materials Science and Engineering*, *429*, 012029. https://doi.org/10.1088/1757-899x/429/1/012029

Abdullah, M., Ali, N., Javid, M., Dias, C., & Campisi, T. (2021). Public transport versus solo travel mode choices during the COVID-19 pandemic: self-reported evidence from a developing country. *Transportation Engineering*, *5*, 100078. https://doi.org/10.1016/j.treng.2021.100078

Abdul-Rahman, H., Wang, C., Wood, L., & Khoo, Y. (2014). Defects in affordable housing projects in Klang Valley, Malaysia. *Journal of Performance of Constructed Facilities*, *28*(2), 272–285. https://doi.org/10.1061/(ASCE)CF.1943-5509.0000413

Adabre, M., & Chan, A. (2020). Towards a sustainability assessment model for affordable housing projects: the perspective of professionals in Ghana. *Engineering, Construction and Architectural Management*, *27*(9), 2523–2551. https://doi.org/10.1108/ecam-08-2019-0432

Aditjandra, P., Cao, X., & Mulley, C. (2012). Understanding neighbourhood design impact on travel behaviour: an application of structural equations model to a British metropolitan data. *Transportation Research Part A: Policy and Practice*, *46*(1), 22–32. https://doi.org/10.1016/j.tra.2011.09.001

Afiqah, N., Kamarul Bahrin, N., & Rozman, A. (2020). Housing affordability preferences for 'Rumah Selangorku' scheme. *Journal of Sustainable Technology and Applied Science*, *1*(2), 1–8. https://doi.org/10.36040/jstas.v1i2.3019

Aloul, S., Naffa, R., & Mansour, M., (2018). *Gender in public transportation: a perspective of women users of public transportation*. https://library.fes.de/pdf-files/bueros/amman/15221.pdf

AlQahtany, A. (2020). People's perceptions of sustainable housing in developing countries: the case of Riyadh, Saudi Arabia. *Housing, Care and Support*, *23*(3/4), 93–109. https://doi.org/10.1108/hcs-05-2020-0008

Aminnuddin, N. (2020). Ethnic differences and predictors of racial and religious discriminations among Malaysian Malays and Chinese. *Cogent Psychology*, *7*(1), 1766737. https://doi.org/10.1080/23311908.2020.1766737

Bakhtyar, B., Zaharim, A., Sopian, K., Saadatian, O., & Abdulateef, J. (2012). Affordable quality housing for urban low income earners in Malaysia. *SSRN Electronic Journal*, 60–73. https://doi.org/10.2139/ssrn.2184629

Bernama. (2021). Analysis: mental health issues growing more serious. *The Star*. https://www.thestar.com.my/news/nation/2021/07/02/analysis-mental-health-issues-growing-more-serious

Bilal, M., Meera, A., & Abdul Razak, D. (2019). Issues and challenges in contemporary affordable public housing schemes in Malaysia. *International Journal of Housing Markets and Analysis*, *12*(6), 1004–1027. https://doi.org/10.1108/IJHMA-11-2018-0091

Birruntha, S. (2022). KPKT focuses on affordable quality housing. *The Malaysian Reserve*. https://themalaysianreserve.com/2022/01/24/kpkt-focuses-on-affordable-quality-housing/

Boumeester, H. J. (2011). Traditional housing demand research. In *The measurement and analysis of housing preference and choice* (pp. 27–55). Springer. https://doi.org/10.1007/978-90-481-8894-9_2

Brundtland, G. H. (1987). Report of the World Commission on environment and development: "our common future". UN.

Bujang, A., Jiram, W., Zarin, H., & Anuar, F. (2015). Measuring the Gen Y housing affordability problem. *International Journal of Trade, Economics and Finance*, *6*(1), 22–26. https://doi.org/10.7763/ijtef.2015.v6.435

Chan, A. P., & Adabre, M. A. (2019). Bridging the gap between sustainable housing and affordable housing: the required critical success criteria (CSC). *Building and Environment*, *151*, 112–125. https://doi.org/10.1016/j.buildenv.2019.01.029

Department of Economic and Social Affairs. (2022). *The Sustainable Development Goals Report 2022*. United Nations Publications.

Department of Statistics Malaysia. (2020). *Household Income & Basic Amenities Survey Report 2019*. Putrajaya.

Department of Statistics Malaysia. (2021). *Malaysia @ a Glance*. Putrajaya.

Department of Statistics Malaysia. (2022, January). *Key statistics of labour force in Malaysia*. Putrajaya.

Delgado, A., & De Troyer, F. (2017). Housing preferences for affordable social housing projects in Guayaquil, Ecuador. *International Journal of Housing Markets and Analysis, 10*(1), 112–139. https://doi.org/10.1108/IJHMA-02-2016-0017

Economic Planning Unit. (2015). *Eleventh Malaysia plan 2016-2020*. The Economic Planning Unit, Prime Minister's Department.

Enterprise Community Partners. (2014). *Impact of affordable housing on families and communities: a review of the evidence base*. https://homeforallsmc.org/wp-content/uploads/2017/05/Impact-of-Affordable-Housing-on-Families-and-Communities.pdf

Ezennia, I., & Hoskara, S. (2019). Exploring the severity of factors influencing sustainable affordable housing choice: evidence from Abuja, Nigeria. *Sustainability*, *11*(20), 5792. https://doi.org/10.3390/su11205792

Fakere, A. A., & Ayoola, H. A. (2018). Socioeconomic characteristics and community participation in infrastructure provision in Akure, Nigeria. *Cogent Social Sciences*, *4*(1), 1437013. https://doi.org/10.1080/23311886.2018.1437013

Galster, G., & Lee, K. (2020). Introduction to the special issue of the Global crisis in housing affordability. *International Journal of Urban Sciences*, *25*(sup1), 1–6. https://doi.org/10.1080/12265934.2020.1847433

Gan, X., Zuo, J., Wu, P., Wang, J., Chang, R., & Wen, T. (2017). How affordable housing becomes more sustainable? A stakeholder study. *Journal of Cleaner Production*, *162*, 427–437. https://doi.org/10.1016/j.jclepro.2017.06.048

Ghazali, N., Marzukhi, M., & Ling, O. (2021). Urban low-cost housing effect mental health. *Planning Malaysia*, *19*(4), 244–256. https://doi.org/10.21837/pm.v19i18.1049

Golubchikov, O., & Badyina, A. (2012). *Sustainable housing for sustainable cities: a policy framework for developing countries.* UN-Habitat.

Grinstein-Weiss, M., Charles, P., Guo, S., Manturuk, K., & Key, C. (2011). The effect of marital status on home ownership among low-income households. *Social Service Review*, *85*(3), 475–503. https://doi.org/10.1086/662166

Hassan, M., Ahmad, N., & Hashim, A. (2021). Factors influencing housing purchase decision. *International Journal of Academic Research in Business and Social Sciences*, *11*(7), 429–443. https://doi.org/10.6007/ijarbss/v11-i7/10295

Hoxha, V., & Zeqiraj, E. (2019). The impact of Generation Z in the intention to purchase real estate in Kosovo. *Property Management*, *38*(1), 1–24. https://doi.org/10.1108/pm-12-2018-0060

Ibrahim, I. A. (2020). Sustainable housing development: role and significance of satisfaction aspect. *City, Territory and Architecture*, *7*(1), 21. https://doi.org/10.1186/s40410-020-00130-x

Jabatan Perumahan Negara. (2019). *Dasar Perumahan Mampu Milik Negara*. Putrajaya.

Kam, K., Lim, A., Al-Obaidi, K., & Lim, T. (2018). Evaluating housing needs and preferences of Generation Y in Malaysia. *Planning Practice & Research*, *33*(2), 172–185. https://doi.org/10.1080/02697459.2018.1427413

Kamaruzzaman, S., & Azmal, A. (2019). Evaluation of occupants' well-being and perception towards indoor environmental quality in Malaysia affordable housing. *Journal of Facilities Management*, *17*(1), 90–106. https://doi.org/10.1108/jfm-11-2017-0070

Khan, R. A. J., Thaheem, M. J., & Ali, T. H. (2020). Are Pakistani homebuyers ready to adopt sustainable housing? An insight into their willingness to pay. *Energy Policy*, *143*, 111598. https://doi.org/10.1016/j.enpol.2020.111598

Kim, J., & Yoo, S. (2021). Perceived health problems of young single-person households in housing poverty living in Seoul, South Korea: a qualitative study. *International Journal of Environmental Research and Public Health*, *18*(3), 1067. https://doi.org/10.3390/ijerph18031067

Kim, M., Cho, M., & Jun, H. (2020). Developing design solutions for smart homes through user-centered scenarios. *Frontiers in Psychology*, *11*, 335. https://doi.org/10.3389/fpsyg.2020.00335

Koh, F., & Mustapa, F. (2021). Smart living implementation in Malaysia: a preliminary overview. *Journal of Information System and Technology Management*, *6*(24), 79–89. https://doi.org/10.35631/jistm.624008

Latimaha, R., Bahari, Z., & Ismail, N. (2019). Middle income household spending patterns on housing in Malaysian state capital cities: where does all the money go? *Jurnal Ekonomi Malaysia*, *53*(2), 55–65. https://doi.org/10.17576/jem-2019-5302-5

Li, J., Auchincloss, A., Rodriguez, D., Moore, K., Diez Roux, A., & Sánchez, B. (2019). Determinants of residential preferences related to built and social environments and concordance between neighborhood characteristics and preferences. *Journal of Urban Health*, *97*(1), 62–77. https://doi.org/10.1007/s11524-019-00397-7

Li, Q., Long, R., & Chen, H. (2018). Differences and influencing factors for Chinese urban resident willingness to pay for green housings: evidence from five first-tier cities in China. *Applied Energy*, *229*, 299–313. https://doi.org/10.1016/j.apenergy.2018.07.118

Lindstrom, C. T. (2019). *The relationship between housing affordability and demographic factors: case study for the Atlanta Beltline* [Master's thesis, Georgia Southern University]. Electronic Theses and Dissertations. https://digitalcommons.georgiasouthern.edu/cgi/viewcontent.cgi?article=3083&context=etd

Liu, J., & Ong, H. (2021). Can Malaysia's national affordable housing policy guarantee housing affordability of low-income households? *Sustainability*, *13*(16), 8841. https://doi.org/10.3390/su13168841

Ma, L. L. (2018, May). A brief analysis of the relationship between housing, mental health and wellbeing under the eco-city context. In *4th Annual International Conference on Management, Economics and Social Development* (*ICMESD 2018*) (pp. 930–935). Atlantis Press. https://doi.org/10.2991/icmesd-18.2018.159

Majid, R., Said, R., & Daud, M. (2012). The impact of buyers' demography on property purchasing. *Journal of Surveying, Construction & Property*, *3*(2), 1–18. https://doi.org/10.22452/jscp.vol3no2.1

Mat Lazim, M. S. (2020). *Evolution of migration for urban and rural*. Department of Statistics Malaysia. https://www.dosm.gov.my/v1/uploads/files/6_Newsletter/Newsletter%202020/DOSM_BPPD_4-2020_Series-62.pdf

Md. Yassin, A., Masrom, M., & Yahya, M. (2021). Measuring sustainability elements in PR1MA affordable housing. *International Journal of Sustainable Construction Engineering and Technology*, *12*(5), 286–293. https://doi.org/10.30880/ijscet.2021.12.05.029

Moghayedi, A., Awuzie, B., Omotayo, T., Le Jeune, K., Massyn, M., Ekpo, C. O., Braune, M., & Byron, P. (2021). A critical success factor framework for implementing sustainable innovative and affordable housing: a systematic review and bibliometric analysis. *Buildings*, *11*(8), 317. https://doi.org/10.3390/buildings11080317

Moghimi, V., Jusan, M., & Izadpanahi, P. (2016). Iranian household values and perception with respect to housing attributes. *Habitat International*, *56*, 74–83. https://doi.org/10.1016/j.habitatint.2016.04.008

Mohamad, Z., Yang, F., Charles Ramendran, S., Rehman, M., Nee, A., & Yin, Y. (2020). Embedding eco-friendly and smart technology features in affordable housing for community happiness in Malaysia. *Geojournal*, *87*(1), 167–181. https://doi.org/10.1007/s10708-020-10247-8

Mridha, M. (2020). The effect of age, gender and marital status on residential satisfaction. *Local Environment*, *25*(8), 540–558. https://doi.org/10.1080/13549839.2020.1801615

Musa, M. K., Rahman, M. A. A., Azman, M. N. A., Lip, R., & Hashim, N. (2021, July). Measuring residents' satisfaction on quality of low-cost affordable housing projects: an empirical investigation. In *AIP Conference Proceedings* (Vol. 2347, No. 1, p. 020062). AIP Publishing LLC. https://doi.org/10.1063/5.0052147

Myeda, N. E., Kamaruzzaman, S. N., Zaid, S. M., & Fong, Y. P. (2016). Sustainable housing: demographic analysis of customers' demands in Klang Valley. *Journal of Building Performance*, *7*(1), 116–124.

National Property Information Centre. (2018). *Stock and status residential Q1 2018*. http://napic.jpph.gov.my/portal

National Property Information Centre. (2021). *Property market status H1 2021*. http://napic.jpph.gov.my/portal

O'Connell, A. (2006). *Logistic regression models for ordinal response variables*. Sage Publications. https://doi.org/10.4135/9781412984812

Olanrewaju, A., & Tan, S. (2018). An exploration into design criteria for affordable housing in Malaysia. *Journal of Engineering, Design and Technology*, *16*(3), 360–384. https://doi.org/10.1108/jedt-12-2017-0125

Olanrewaju, A., & Wong, H. (2019). Evaluation of the requirements of first time buyers in the purchase of affordable housing in Malaysia. *Journal of Housing and the Built Environment*, *35*(1), 309–333. https://doi.org/10.1007/s10901-019-09681-z

Olanrewaju, A., & Woon, T. C. (2017). An exploration of determinants of affordable housing choice. *International Journal of Housing Markets and Analysis*, *10*(5), 703–723. https://doi.org/10.1108/IJHMA-11-2016-0074

Olanrewaju, A., Tan, S., & Abdul-Aziz, A. (2018). Housing providers' insights on the benefits of sustainable affordable housing. *Sustainable Development*, *26*(6), 847–858. https://doi.org/10.1002/sd.1854

Olanrewaju, A., Tan, Y., & Soh, S. (2022). Defect characterisations in the Malaysian affordable housing. *International Journal of Building Pathology and Adaptation*, *40*(4), 539–568. https://doi.org/10.1108/ijbpa-11-2018-0095

Oni-Jimoh, T., & Liyanage, C. (2018). Urbanization and meeting the need for affordable housing in Nigeria. In A. Almusaed & A. Almssad (Eds.), *Housing*. IntechOpen. https://doi.org/10.5772/intechopen.78576

Opoku, R., & Abdul-Muhmin, A. (2010). Housing preferences and attribute importance among low-income consumers in Saudi Arabia. *Habitat International*, *34*(2), 219–227. https://doi.org/10.1016/j.habitatint.2009.09.006

Oyebanji, A., Liyanage, C., & Akintoye, A. (2017). Critical success factors (CSFs) for achieving sustainable social housing (SSH). *International Journal of Sustainable Built Environment*, *6*(1), 216–227. https://doi.org/10.1016/j.ijsbe.2017.03.006

Park, J., Heo, Y., Oh, U., & Yoon, S. (2015). Changes in physical and mental health as a function of substandard housing conditions and unaffordable housing. *Korean Journal of Social Welfare*, *67*(2), 137–159. https://doi.org/10.20970/kasw.2015.67.2.006

Plouin, M. (2019, May). Affordable housing and homelessness: challenges across the OECD. In *UN expert group meeting on affordable housing and social protection systems for all to address homelessness*. OECD.

Saidu, A., & Yeom, C. (2020). Success criteria evaluation for a sustainable and affordable housing model: a case for improving household welfare in Nigeria cities. *Sustainability*, *12*(2), 656. https://doi.org/10.3390/su12020656

Saliu, I., & Akiomon, E. (2022). Sustainable housing in developing countries: a reality or a mirage. In I. Saliu & E. Akiomon (Eds.), *Sustainable housing*. IntechOpen. https://doi.org/10.5772/intechopen.99060

Salleh, N., Yusof, N., Johari, N., & Talib, Y. (2014). Identifying variables influencing tenant affordability to pay rent in Ipoh city council public housing. *E3S Web of Conferences*, *3*, 01006. https://doi.org/10.1051/e3sconf/20140301006

Sekaran, U., & Bougie, R. (2010). *Research methods for business: a skill building approach* (5th ed.). John Wiley and Sons.

Shi, X. (2022). Environmental health perspectives for low-and middle-income countries. *Global Health Journal*, *6*(1), 35–37. https://doi.org/10.1016/j.glohj.2022.01.003

Soon, J., & Ahmad, S. (2015). Willingly or grudgingly? A meta-analysis on the willingness-to-pay for renewable energy use. *Renewable and Sustainable Energy Reviews*, *44*, 877–887. https://doi.org/10.1016/j.rser.2015.01.041

Sreen, N., Purbey, S., & Sadarangani, P. (2018). Impact of culture, behavior and gender on green purchase intention. *Journal of Retailing and Consumer Services*, *41*, 177–189. https://doi.org/10.1016/j.jretconser.2017.12.002

Syed Jamaludin, S. Z., Mahayuddin, S. A., & Hamid, S. H. (2018). Challenges of integrating affordable and sustainable housing in Malaysia. *IOP Conference Series: Earth and Environmental Science*, *140*, 012001. https://doi.org/10.1088/1755-1315/140/1/012001

Tan, T. (2012). Housing satisfaction in medium- and high-cost housing: the case of Greater Kuala Lumpur, Malaysia. *Habitat International*, *36*(1), 108–116. https://doi.org/10.1016/j.habitatint.2011.06.003

The City & Country Team. (2022). Cover story: prioritising sustainability and liveability. *The Edge Markets*. https://www.theedgemarkets.com/article/cover-story-prioritising-sustainability-and-liveability

Tung, E., Cagney, K., Peek, M., & Chin, M. (2017). Spatial context and health inequity: reconfiguring race, place, and poverty. *Journal of Urban Health*, *94*(6), 757–763. https://doi.org/10.1007/s11524-017-0210-x

Tung, L., & Comeau, J. (2014). Demographic transformation in defining Malaysian generations: the seekers (pencari), the builders (pembina), the developers (pemaju), and Generation Z (Generasi Z). *International Journal of Academic Research in Business and Social Sciences*, *4*(4), 383–403. https://doi.org/10.6007/IJARBSS/v4-i4/809

UN-Habitat. (2011). *Affordable land and housing in Asia*. United Nations Human Settlements Programme. https://unhabitat.org/affordable-land-and-housing-in-asia-2

UNICEF. (2020, August 24). *Families on the Edge: low-income families need continued support to recover from the effects of COVID-19*. https://www.unicef.org/malaysia/press-releases/families-edge-low-income-families-need-continued-support-recover-effects-covid-19

United Nations. (2022). *The Sustainable Development Agenda*. United Nations Sustainable Development. https://www.un.org/sustainabledevelopment/development-agenda/

Yap, J., Yong, P., & Skitmore, M. (2019). Analysing the desired quality of housing in the Klang Valley region, Malaysia. *Pacific Rim Property Research Journal*, *25*(2), 125–140. https://doi.org/10.1080/14445921.2019.1626542

Zhang, L., Chen, L., Wu, Z., Zhang, S., & Song, H. (2018). Investigating young consumers' purchasing intention of green housing in China. *Sustainability*, *10*(4), 1044. https://doi.org/10.3390/su10041044