INVESTIGATING HOUSING PREFERENCES AFTER COVID-19 PANDEMIC IN MALAYSIA

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INVESTIGATING HOUSING PREFERENCES AFTER COVID-19 PANDEMIC IN MALAYSIA

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A project report submitted in partial fulfilment of the requirements for the award of Bachelor of Science (Honours) Quantity Surveying

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September 2022

DECLARATION

I hereby declare that this project report is based on my original work except for citations and quotations which have been duly acknowledged. I also declare that it has not been previously and concurrently submitted for any other degree or award at UTAR or other institutions.

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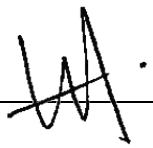
Signature : 

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ABSTRACT

COVID-19 pandemic has brought about profound changes in human social and health related behaviour. The new norm led to a shift in housing preferences as building occupants spent more time at home than previously. Numerous studies were conducted on housing preferences in Malaysia before the outbreak. However, limited studies were dedicated to housing preferences in the pandemic context. Therefore, this study aims to uncover the housing preferences after the COVID-19 pandemic in Malaysia. The objectives of this study are to identify post-COVID-19 housing preferences in Malaysia, to evaluate the importance level of post-COVID-19 housing preferences in Malaysia and to investigate the influence of social demographics on post-COVID-19 housing preferences in Malaysia. The identified fifty-one post-COVID-19 housing preferences were important to homebuyers in purchasing a home and categorised into eight parameters, which are financial, locational, physical, structural and equipment, spatial arrangement, health and comfort, green and technological. A quantitative approach was adopted for this study. Online and hand-delivered questionnaires were distributed to homebuyers in Klang Valley and 141 responses were collected. Data obtained were then analysed by Cronbach Alpha Reliability Test, Friedman Test, Mann-Whitney U Test, and Kruskal-Wallis. The results discovered that homebuyers would most prioritise health and comfort parameters after the pandemic. Besides, homebuyers with distinct gender, ages, ethnicity, marital status, household size, educational level and income levels have different preferences in purchasing a home. The findings of the research are useful to the property and the housing industry in understanding the latest demand and trends from the perspective of homebuyers after the COVID-19 pandemic.

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LIST OF SYMBOLS / ABBREVIATIONS

e	margin of error
n	sample size
p	the proportion of the population with attributes understudy
q	1-p
z	the z-scores of the desired confidence level

CLT	Central Limit Theorem
COVID-19	Coronavirus disease
IAQ	Indoor Air Quality
MCO	Movement Control Order
OPR	Overnight Policy Rate
SBS	Sick Building Syndrome
SOP	Standard Operating Procedure
SPSS	Statistical Package for the Social Science
VOC	Volatile Organic Compounds
WFH	Work from Home
WHO	World Health Organisation

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter provides an overview of this research, including the background of the study, problem statement, aim, objectives, research methodology, research scope and chapter outline.

1.2 Background of the Study

Coronavirus disease (COVID-19), a novel strain of the virus that causes respiratory infections in humans, has been striking the world since early 2020. Physical distancing, staying at home, and self-isolation are urged by the World Health Organisation (WHO) to prevent transmission (WHO, 2021). Malaysia had imposed a Movement Control Order (MCO) from 18 March 2020 to 12 May 2020 to tackle the outbreak through movement confinement and social restrictions. The restrictions included school closings, border crossings, patients' quarantines, and staying at home with limited outings for solely groceries or necessities (Fan and Cheong, 2020).

Globally, the effect of the pandemic has been severe and unprecedented, negatively impacting society. The impact was exacerbated during lockdowns when citizens were forced to stay at home for precautionary reasons. E-education and a work-from-home culture facilitated remote working from the workplace and synchronous learning from schools had been implemented. Consequently, family time increased as the house became the focal point for all household activities (Verma and Prakash, 2020). Moreover, most shopping and purchasing events took place at home (Ginee, 2021), owing to the limited travelling distance and the lack of walk-ins.

Despite the lifting of lockdown measures post-MCO, safety concerns still remain a top priority. A large number of people would prefer to stay at home (Habibu, 2020) and have a hybrid mode of both learning (Project ID, 2021) and working (Menon and Yuen, 2022). In line with the research conducted in South Korea (Park, et al., 2021) and India (Verma and Prakash, 2020), the population's lifestyle had altered before and after the pandemic in how they work, live, play, and rest at home. Undeniably, COVID-19's impact has a long-term effect on living

behaviour. Consequently, occupants will reshape their housing preferences based on the lifestyle changes and seek housing that accommodates their new needs.

On the other hand, housing is a basic physiological need associated with health, highlighted by the recent pandemic. According to Tinson and Clair (2020), about seven million households in England had major housing problems, which could worsen their health during the outbreak. In fact, the pandemic could aggravate housing issues such as poor quality and overcrowding. Consequently, the former issue exacerbates physical health, while the latter intensifies mental health (Tinson and Clair, 2020). Moreover, the risk of infection is more remarkable when living in unsafe shelters. Therefore, it is crucial to reconsider the health implications of housing, with rising global concerns about safety and health.

To sum up, new norms have emerged after the COVID-19 pandemic due to lifestyle changes and increased health concerns. The public has begun to reflect on the importance of housing for a healthy lifestyle. This resulted in a considerable shift in customer needs and preferences regarding housing. It is recommended that real estate players shall cater to the changing housing preferences post-COVID-19 as part of their property development to meet the new market expectations (Hamzah, Yazid and Shamsudin, 2020). As a result, this research aims to study the housing preferences of Malaysians after COVID-19 to provide developers with an outline of the latest housing demand in response to the structural change.

1.3 Problem Statement

Prior to the COVID-19 pandemic, housing preferences had been extensively explored globally. Among the countries that had studied housing preferences in their respective regions were China (Wu, 2010), India (Ghumare, Chauhan and Yadav, 2020), Saudi Arabia (Opoku and Abdul-Muhmin, 2010), Sweden (Kim, 2020), and Turkey (Gunes, et al., 2016), with varying scopes of study. In Malaysia, the housing preferences of first-time homebuyers (Khan, et al., 2017), Generation Y (Kam, et al., 2018), urban youths (Leh, Mansor and Musthafa, 2017) and homebuyers in Kuala Lumpur (Thanaraju, et al., 2019) were all examined by different authors. Despite that, the housing preferences assessed before the pandemic have come under scrutiny as the preferences have changed since the COVID-19 pandemic began.

In the aftermath of the COVID-19 pandemic, the COVID-19 impacts have been primarily investigated worldwide. Several studies have been carried out related

to the COVID-19 pandemic and housing. For instance, Muhyi and Adianto (2021) evaluated the housing preferences influenced by the COVID-19 pandemic-driven home behaviour in Indonesia. The post-COVID-19 preferences for a healthy home were assessed in Iran (Zarrabi, Yazdanfar and Hosseini, 2021), whereas the post-COVID-19 preferences for green housing were examined in Lithuania (Kaklauskas, et al., 2021). In addition, research in the United Kingdom provided a viewpoint on future housing based on the COVID-19 implications for housing (Nanda, et al., 2021). These findings indicated that homebuyers' preferences have shifted toward a safer, healthier and more sustainable house.

In Malaysia, however, there is a lack of studies concerning the COVID-19 pandemic and housing preferences. The available pandemic-related research included research on Malaysia's future real estate sector in term of risk, opportunity, and marketing strategies (Hamzah, Yazid and Shamsudin, 2020). Additionally, the challenges and outlook for property development during the COVID-19 pandemic were analysed by Jagun, et al. (2022). Meanwhile, Tham (2021) identified the factors influencing house purchasing during the COVID-19 pandemic, emphasising housing purchase decisions instead of analysing homebuyers' preferences. Since fewer studies have been found that surveyed post-COVID-19 housing preferences in Malaysia, it is therefore critical to bridge the gap between pre- and post-COVID-19 housing preferences. This study aims to investigate post-COVID-19 housing preferences from the homebuyers' perspective. It is anticipated that stakeholders can apply the findings of this study to address the shifting preferences in the post-pandemic housing market.

1.4 Research Aim

This research aims to uncover housing preferences after the COVID-19 pandemic in Malaysia.

1.5 Research Objectives

To achieve the aim of the research, three objectives are formulated.

(i) To identify post-COVID-19 housing preferences in Malaysia.

(ii) To evaluate the importance level of post-COVID-19 housing preferences in Malaysia.

(iii) To investigate the influence of social demographics on post-COVID-19 housing preferences in Malaysia.

1.6 Research Methodology

A quantitative approach was adopted. A questionnaire was designed in Google Form and distributed to homebuyers in Klang Valley via electronic and paper form. A total of 141 sets of valid responses were received and analysed via Cronbach's Alpha Reliability Test, Friedman Test, Mann-Whitney U Test and Kruskal-Wallis Test.

1.7 Research Scope

This research focuses on homebuyers in Klang Valley with a minimum age of twenty-one. There were no boundaries set on gender, ethnicity, income level, and educational background of respondents. The purpose is to get as many responses as possible from respondents across diverse demographic profiles.

1.8 Chapter Outline

This research is structured into five chapters. Chapter one introduces the background of the study, describing the relationship between the current COVID-19 situation and housing. This chapter provides the problem statement, identifies the aim and objectives, and explains the methodology, the scope, and the chapter outline.

Chapter two discusses housing preferences in the post-COVID-19 era by reviewing the previous literature and studies. The definition of housing preference and the post-COVID-19 housing preference are also covered.

Subsequently, chapter three demonstrates the research methodology to be applied and designed to attain the aim and the objectives. Likewise, the strategy for data collection and data analysis is outlined.

Chapter four presents the interpretation of the collected data from the questionnaire survey and the analysis results. The findings are compared with preceding studies to verify their legitimacy.

Last but not least, chapter five summarises the achievements of established aim and objectives and their contributions to the industry. Moreover, the encountered limitations and recommendations for future study are proposed.

1.9 Chapter Summary

In conclusion, the focus of this study was determined based on the revealed research gap on housing preferences after the COVID-19 pandemic. In this chapter, the problem statement was clarified, and the aims and objectives were developed to fill in the knowledge gap. In addition, the methodology for conducting research has been discussed, as well as the outline for each chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter assembles the review of relevant literature on housing preference in the aftermath of the COVID-19 pandemic. It includes the nature of housing preferences, the housing preferences under the impact of the COVID-19 pandemic, and the influence of social demographics on housing preferences.

2.2 Housing Preferences

According to Jansen, Coolen and Goetgeluk (2011), housing preference is defined as the subjective attractiveness of housing. The housing preference differs from housing choice, which refers to the actual purchase behaviour. The former aids in guiding and assessing the latter. The real housing choice might not be highly correlated with the housing preference (Jansen, Coolen and Goetgeluk, 2011) but still reflects the average preferences in the market (Molin, Oppewal and Timmermans, 1996). This statement explains that housing preferences drive housing choice. Hence, understanding preferences is crucial in predicting potential housing purchase decisions.

Morris and Winter (1975) introduced a housing adjustment theory that has been extensively applied to understand housing preferences. According to the theory, the current living environment will be evaluated dynamically. Housing adjustment occurs when housing conditions do not coincide with occupants' satisfaction or norms (Morris and Winter, 1975), shifting their housing preferences. In other words, the preferences and choices will constantly change according to their arising housing needs from new norms. In this regard, housing preferences may vary in the context of a pandemic to accommodate the new norm of living with viruses.

2.2.1 Housing Preferences in Malaysia before COVID-19 Pandemic

Hassan, Ahmad and Hashim (2021) concluded that nine aspects affect housing purchase decisions in Malaysia: finance, location, environment, neighbourhood, infrastructure facilities, developer service quality, superstition belief, dwelling

characteristics and demographic background. The most frequently discussed were finance, location, neighbourhood, and housing characteristics among the indicators.

Findings on Malaysian housing preferences vary depending on the researched location and the target age group. For instance, a survey of housing purchase decisions revealed that location is the single factor considered when buying a home (Thanaraju, et al., 2019). However, the outcome may be one-sided because the survey was conducted in Kuala Lumpur, the capital of Malaysia, where respondents' day-to-day lives are primarily centred. In contrast, several research studies have found that financial factors are the primary concern of youth and first-time homebuyers with limited affordability (Khan, et al., 2017; Ismail, et al., 2021). In brief, with varying requirements, needs and affordability, an individual's housing preference can be influenced by a diverse range of factors in Malaysia.

2.2.2 Housing Preference Shift due to COVID-19 Pandemic

Since the COVID-19 pandemic, the concept of social distancing, isolation, quarantines, disinfections, and lockdowns have been introduced. Public awareness was raised to prevent disease transmission (Gur, 2021). Under the policy and Standard Operating Procedure (SOP), lifestyles and habits changed dramatically. Subsequently, the home adjustment occurs in response to pandemic behaviour changes, which subsequently shift housing preferences.

According to Gur (2021), the pandemic impacted social relationships, nutrition, physical activities, public transportation, education, and shopping. As a result of lockdowns, social activity was reduced, which was then substituted by social interaction via digital technologies. In addition, isolated individuals tend to be anxious and tense, leading to adverse psychological effects. The changes in nutrition, physical activities, and sports habits lead to overeating, affecting physical health. Moreover, public transit usage declined while distance learning and online shopping increased (Gur, 2021).

Muhyi and Adianto (2021) explained that the COVID-19 pandemic drove the fear of meeting people, economic recession, and stay-at-home lifestyles. Due to the fear of meeting people, people tend to avoid places that transmit viruses and high-risk locations to ensure their safety. To deal with economic uncertainty, people may reduce their housing expenses, seek affordable housing and consider a lower-price location (Muhyi and Adianto, 2021). Additionally, staying-at-home protocols

lead to social isolation and a loss of connection with nature (Peters and Halleran, 2020). The role of the house was changed to serve other purposes beyond a shelter. Consequently, there is a need for a house with a large size, outdoor space, green views, and good indoor quality.

To conclude, the occupant has become increasingly concerned about housing quality in health, safety, and sustainability in the wake of the pandemic. Hence, post-pandemic housing should be able to adapt to a new lifestyle and support more efficient and healthier living (Gur, 2021). As such, the current home and built environment might not satisfy the new needs and quality of life. In that case, the occupants will shift their housing preference and consider COVID-19 impacts in purchasing future housing. Therefore, it is necessary to redefine housing preference after the COVID-19 pandemic.

2.3 Housing Preference after COVID-19 Pandemic

As living behaviour changes, the current housing may no longer meet the new contextual norm, resulting in a housing preference shift to accommodate the new COVID-19-related lifestyle. The post-COVID-19 housing preference can be generalised under eight distinct parameters: financial, locational, physical, space arrangement, structural and equipment, health and comfort, green and technological. According to the previous studies, a list of post-COVID-19 housing preferences was tabulated in Table 2.1.

Table 2.1: Previous Studies on Post-COVID-19 Housing Preferences.

No.	Influencing Factor	Previous Studies
	Financial Parameter	
1	Affordability	Muhyi and Adianto (2021); Tham (2021)
2	Interest Rate	Tham (2021)
3	Loan Service	Tham (2021)
4	Government Subsidy	Muhyi and Adianto (2021); Tham (2021)
5	Financial Institution Support	Tham (2021)
	Locational Parameter	
6	Community Type	Kaklauskas, et al. (2021); Nanda, et al. (2021)
7	Community Density	Liu and Su (2021)
8	Neighbourhood Quality	Nanda, et al. (2021); Tham (2021)
9	Accessibility to Restaurant and Groceries Market	Nanda, et al. (2021)
10	Accessibility to Healthcare Facilities	Nanda, et al. (2021)
11	Accessibility to Recreational Facilities	Nanda, et al. (2021)
12	Accessibility to Workplace	Nanda, et al. (2021)
13	Accessibility to Public Transport	Nanda, et al. (2021)
14	Accessibility to Fibre-optic Broadband Services	Nanda, et al. (2021)
15	Accessibility to Home Delivery	Karlsson (2022)
	Physical Parameter	
16	Housing Type	Peters and Halleran (2020); Akbari, et al. (2021); Kaklauskas, et al. (2021); Muhyi and Adianto (2021)
17	Housing Size and Space	Amerio, et al. (2020); D'Alessandro, et al. (2020); Peters and Halleran (2020); Ghimire, et al. (2021); Nanda, et al. (2021); Rosa-Jimenez and Jaime-Segura (2022)
18	Adaptability and Flexibility of Space	Cuerdo-Vilches, Navas-Martin and Oteiza (2020); D'Alessandro, et al. (2020); Peters and Halleran (2020); Bettaieb and Alsabban (2021); Gur (2021); Nanda, et al. (2021)
19	Spatial Design for Privacy	Amerio, et al. (2020); D'Alessandro, et al. (2020); Peters and Halleran (2020); Kaklauskas, et al. (2021)

Table 2.1 (Cont'd)

No.	Influencing Factor	Previous Studies
20	Number of Rooms	Peters and Halleran (2020); Nanda, et al. (2021); Zarrabi, Yazdanfar and Hosseini (2021)
	Space Arrangement Parameter	
21	Additional or Separated Bathroom	Peters and Halleran (2020); Kaklauskas, et al. (2021)
22	Separated Kitchen	Gur (2021)
23	Entrance with Cleaning and Washing Area	Gur (2021); Zarrabi, Yazdanfar and Hosseini (2021)
24	Disinfection Area	Gur (2021)
25	Drop-off Zone for Home Delivery	Kaklauskas, et al. (2021)
26	Extra Storage Spaces	Nanda, et al. (2021)
27	Home Office	Kaklauskas, et al. (2021); Nanda, et al. (2021)
28	Workout Area	Cuerdo-Vilches, Navas-Martin and Oteiza (2020)
29	Recreational Area (Balcony, Terrace, Outhouse, Garden)	Amerio, et al. (2020); Peters and Halleran (2020); Akbari, et al. (2021); Bettaieb and Alsabban (2021); Gur (2021); Nanda, et al. (2021); Zarrabi, Yazdanfar and Hosseini (2021)
	Structural and Equipment Parameter	
30	Natural Ventilation System	Cuerdo-Vilches, Navas-Martin and Oteiza (2020); D'Alessandro, et al. (2020); Peters and Halleran (2020); Zarrabi, Yazdanfar and Hosseini (2021)
31	Air-conditional System	Toosty, et al. (2022)
32	Natural Lighting System	Cuerdo-Vilches, Navas-Martin and Oteiza (2020); D'Alessandro, et al. (2020); Zarrabi, Yazdanfar and Hosseini (2021)
33	Sound Insulation	Cuerdo-Vilches, Navas-Martin and Oteiza (2020); D'Alessandro, et al. (2020); Peters and Halleran (2020); Nanda, et al. (2021)
34	Safe Building Material	D'Alessandro, et al. (2020); Nanda, et al. (2021); Zarrabi, Yazdanfar and Hosseini (2021)
35	Energy-efficient Features	D'Alessandro, et al. (2020); Nanda, et al. (2021); Zarrabi, Yazdanfar and Hosseini (2021)

Table 2.1 (Cont'd)

No.	Influencing Factor	Previous Studies
	Health and Comfort Parameter	
36	Indoor Air Quality (IAQ)	Cuerdo-Vilches, Navas-Martin and Oteiza (2020); D'Alessandro, et al. (2020); Akbari, et al. (2021); Nanda, et al. (2021); Zarrabi, Yazdanfar and Hosseini (2021)
37	Thermal Comfort	Amerio, et al. (2020); Cuerdo-Vilches, Navas-Martin and Oteiza (2020); D'Alessandro, et al. (2020); Peters and Halleran (2020)
38	Lighting Quality	Cuerdo-Vilches, Navas-Martin and Oteiza (2020); Peters and Halleran (2020); Akbari, et al. (2021); Zarrabi, Yazdanfar and Hosseini (2021)
39	Acoustics Quality	Amerio, et al. (2020); Cuerdo-Vilches, Navas-Martin and Oteiza (2020); D'Alessandro, et al. (2020); Peters and Halleran (2020); Akbari, et al. (2021); Zarrabi, Yazdanfar and Hosseini (2021)
40	View Quality	Amerio, et al. (2020); D'Alessandro, et al. (2020); Peters and Halleran (2020); Akbari, et al. (2021); Zarrabi, Yazdanfar and Hosseini (2021)
41	Spaciousness	Nanda, et al. (2021); Zarrabi, Yazdanfar and Hosseini (2021)
	Green Parameter	
42	Green Spaces	Amerio, et al. (2020); D'Alessandro, et al. (2020); Peters and Halleran (2020); Akbari, et al. (2021); Nanda, et al. (2021)
43	Green View	Amerio, et al. (2020); D'Alessandro, et al. (2020)
44	Green Infrastructure (Green Wall, Green Roof)	D'Alessandro, et al. (2020); Zarrabi, Yazdanfar and Hosseini (2021)
45	Gardening Area	D'Alessandro, et al. (2020); Akbari, et al. (2021); Kaklauskas, et al. (2021); Zarrabi, Yazdanfar and Hosseini (2021)
	Technological Parameter	
46	Internet Connectivity	Cuerdo-Vilches, Navas-Martin and Oteiza (2020); D'Alessandro, et al. (2020); Nanda, et al. (2021)
47	Fifth Generation Wireless (5G)	D'Alessandro, et al. (2020)
48	Home Automation	D'Alessandro, et al. (2020); Kaklauskas, et al. (2021); Zarrabi, Yazdanfar and Hosseini (2021)
49	Smart Indoor Management	D'Alessandro, et al. (2020)
50	Smart Wellness System	D'Alessandro, et al. (2020)
51	Security System	D'Alessandro, et al. (2020); Nanda, et al. (2021)

2.3.1 Financial Parameter

COVID-19 pandemic had affected the economy globally and increased poverty. With unemployment and salary reduction, homebuyers are less able to afford a house. Job changes have impacted the ability to pay rent, bills, and mortgages. As a result, individuals who cannot afford the high cost of living in the city centre look forward to more affordable housing (Muhyi and Adianto, 2021). Hence, this parameter discusses the housing preferences regarding the pricing and the presence of monetary support to purchase a house. Factors such as affordability, interest rate, loan service, government subsidy and financial institution support are considered.

Affordability is a significant factor in housing purchases. High-priced housing properties do not appeal to buyers, and low-priced houses tend to be associated with poor quality. Thus, homebuyers will compare the neighbourhood housing properties to establish an appropriate price range for more excellent value with the preferred location. The properties in Selangor, Johor, and Kuala Lumpur with the highest price are not desirable for financially unstable homebuyers. Homebuyers would not consider purchasing a house during the pandemic, even though the Overnight Policy Rate (OPR) is relatively low (Tham, 2021). Besides, individuals in Delhi also consider purchasing housing that can be afforded with their income salary, such as low-rise residential apartments (Shafig, et al., 2020).

Furthermore, interest rates and bank loans play a significant role in housing purchase decisions. The Malaysian financial institutions offer property buyers a home loan with a 3 % to 4 % constant interest rate during the pandemic (Lee, 2020). A low-interest rate reduces borrowing costs and encourages spending on the property. Moreover, the ability to obtain housing financing is vital. The net income determines the eligibility for a mortgage loan (Yeoh, 2017). Especially during the pandemic, individuals were faced with low incomes and increased household debt. Low liquidity makes it difficult for them to obtain bank loans, which delays mortgage loan financing (Tham, 2021). Consequently, it dampens house purchasing due to insufficient funds.

The government’s subsidy and assistance will help in boosting the housing market. In Australia, the government has implemented financial subsidies to support pandemic-affected nations. As a result, overstressed pricing can be reduced, and individuals can manage economic risks without affecting their property and assets (Tham, 2021). Similarly, the Malaysian government has implemented incentive

measures, such as the Housing Credit Guarantee Scheme, to promote property spending and lower the barriers to homeownership (Khoo, 2021). In this economic downturn, financial institutions could also provide additional assistance to ease the financial burden and encourage house purchasing (Tham, 2021). In conclusion, homebuyers may prefer to purchase a house at an affordable price and lower interest rate while getting bank financing and government assistance.

2.3.2 Locational Parameter

A home may be located in an urban, rural, or suburban community (Jansen, 2020), with varying population density and available amenities. Residents always seek a housing location that can accommodate their daily needs, functional requirements, and recreational desires (Nanda, et al., 2021). Inevitably, a good housing location provides the greatest everyday conveniences that reduce travel costs and time. It allows reaching work, education, healthcare, groceries and food, recreational activities and sports, public transportation and religious services. Hence, the location parameter addresses the community type, community density, the availability of amenities and services and neighbourhood quality.

Since densely populated urban areas pose high infection risks, the COVID-19 pandemic has brought the attention of residents to community density. During the pandemic, the necessity for office-based working and the consumption of outdoor amenities decreases. Consequently, it reduces the need to live in a high-density community where workplaces and amenities are mainly located (Liu and Su, 2021). According to Cheung, Yiu and Xiong (2021), a preference arises for lower-density regions in rural to survive infectious diseases. Furthermore, Nanda, et al. (2021) forecasted that residents may prefer larger houses, leading them to move to a suburb or rural area. Similarly, Kaklauskas, et al. (2021) found that suburban neighbourhoods closer to cities are preferred by homebuyers because the location is still in proximity to major towns and accessibility but has larger housing space and lower prices.

On top of that, the accessibility to everyday amenities and services became increasingly crucial when residents had to adhere to travel restrictions during the lockdown. In the absence of nearby amenities, households may have difficulty acquiring daily necessities (Nanda, et al., 2021). It needs to ensure that groceries and food can be obtained from nearby supermarkets, shops, or restaurants. In addition,

access to healthcare is essential for the rapid COVID-19 test and treatment of ailments whenever suspicious symptoms occur. Meanwhile, numerous amenities are available in compact cities, but fewer in rural areas. In contrast, rural areas have better accessibility to green spaces and recreational areas than cities (Nanda, et al., 2021).

Geographic location with fibre-optic broadband service is anticipated to be a critical preference due to the growth of digitalisation and reliance on the internet (Nanda, et al., 2021). As online shopping and food delivery expand, it may be vitally necessary for rural areas to have delivery access to their homes (Karlsson, 2022). Nonetheless, a decreased use of public transit during the pandemic (Gur, 2021) and the possible future emergence of suburban employment hubs (Nanda, et al., 2021) may shift the preference for accessibility to public transportation and the workplace.

Beyond that, a high-quality neighbourhood provides a sense of security, nature exploration, and tranquillity. The number of crimes in Malaysia increased due to mass unemployment during the pandemic. In this regard, residents prefer to live in a safe and guarded area to ensure security. Further, a neighbourhood with a landscape and peacefulness stimulates housing preference. Despite the higher price, housing in quieter locations is more expensive than in noisy areas (Tham, 2021).

To sum up, there are two distinct types of community preferences: the urban preference favours higher density, more amenities nearby, and lively communities while the rural preference desires larger space, fewer amenities, and more tranquillity (Jansen, 2020). The choice of housing location is a trade-off between a range of factors, including community density, housing price, space, nearby facilities, and recreational needs. The homebuyers' priorities for the factors above will significantly impact the housing demand.

2.3.3 Physical Parameter

Each housing unit has unique physical features: type, size, number of bedrooms, space and others (Nanda, et al., 2021). There are three basic housing types, including landed, low-rise, and high-rise buildings. In fact, living space should be designed to satisfy the three critical aspects of housing that contribute to human well-being, which are size, flexibility, and privacy. Hence, the physical parameter that reflects the physical characteristics of the building was discussed.

COVID-19 pandemic had created fear of meeting people. Living in a high-rise residential building, such as an apartment or condominium with shared facilities and a common area, is prone to close contact with strangers (Muhyi and Adianto, 2021), overcrowding and disease transmission (Ghimire, et al., 2021). It subsequently exacerbated residents' anxiety. Furthermore, apartment buildings lack the control to respond to pandemic-related needs, such as renovating or adding floor areas (Muhyi and Adianto, 2021). As a result, the homebuyers may favour living in a private landed house instead of an apartment, which is risky and inconvenient (Balemi, Fuss and Weigand, 2021). Kaklauskas, et al. (2021) stated that condominium demand declined as residents tended to move into single-family homes. In addition, it is expected that more residents will prefer living in mid-rise apartments without elevators after the COVID-19 pandemic (Peters and Halleran, 2020).

Living in a small house with limited space impacts daily activities while on lockdown. Inadequate housing size and living space adversely affected residents' mental health during the pandemic (D'Alessandro, et al., 2020; Ghimire, et al., 2021). At least 60 square meters of the surface area is required per housing unit (Amerio, et al., 2020) to prevent overcrowding and ease household tasks. If the housing unit is small, it will need more living space to stay comfortable (Rosa-Jimenez and Jaime-Segura, 2022). Further, the quality of spaces will ensure safety by establishing effective physical distance during pandemics, particularly for apartment units. Moreover, post-pandemic residents may demand a minimum size apartment to have their private space (Peters and Halleran, 2020). With more space, the housing could be more flexible, which is one of the critical preferences during the COVID-19 pandemic (Nanda, et al., 2021).

In light of the pandemic, the adaptability and flexibility of residential spaces are essential to fit lifestyle changes and new needs. Adaptability is defined as the capacity to accommodate substantial changes and cover all human development phases (Milwicz and Paslawski, 2018). The pandemic may cause residents to be more concerned about adaptability to evolving needs and fast-paced changes. Alternatively, flexibility refers to expanding and adding a new function without affecting the overall structure. A partition panel (Gur, 2021), adjustable wall or modular screen (Peters and Halleran, 2020) can be used to create an open floor plan. It allows the building occupants to tailor the apartment layouts to suit the post-COVID-19 lifestyle

(Bettaieb and Alsabban, 2021). As a result, multiple household activities can be accommodated as well as self-isolation in shared units during a pandemic (Peters and Halleran, 2020).

Apart from that, privacy concerns in spatial design are increasingly important as more time is spent at home. Residents prefer environments that allow them to observe other activities while not being overlooked. The physical and spatial separation can make the residents feel more comfortable, safe, and secure (Peters and Halleran, 2020). While staying at home, it is necessary to have privacy for study, work, relax (D'Alessandro, et al., 2020) and have phone calls for personal reasons (Amerio, et al., 2020). In addition, residents tend to have private spaces to escape chaotic life. So, it may shift the preference toward having personal space instead of a space that combines the living room, dining room, kitchen and leisure area (Kaklauskas, et al., 2021).

Increasing home activities and home quarantine demand a greater number of rooms in the house. Isolated patients must stay in a separate room to restrict their movement (Zarrabi, Yazdanfar and Hosseini, 2021). Nevertheless, living in a one- or two-bedroom unit makes physical separation from partners and families difficult (Peters and Halleran, 2020). In the post-pandemic period, Nanda, et al. (2021) suggested that each household should have a private room. This may result in the additional room being needed for multi-functionality. Making use of the extra room may also fulfil the new residents' needs and improve space flexibility (Gur, 2021).

2.3.4 Space Arrangement Parameter

A home serves as more than a shelter during pandemics. In response, households have new requirements for the spatial environment (Salama and Dupre, 2020). For example, a new space may be required to accommodate Work from Home (WFH), isolation, quarantine, limited contact with family members, physical activities, leisure, and gardening at home. Therefore, sought-after spaces after a pandemic are included in this parameter.

Along with an isolated bedroom, the quarantined patient should have access to a separate bathroom (Peters and Halleran, 2020) and a separate kitchen (Gur, 2021). A need may arise for an additional bathroom to avoid sharing enclosed areas with others (Peters and Halleran, 2020; Kaklauskas, et al., 2021). Nevertheless, it is vital to provide a handwashing area, a bathroom, and a toilet near the entrance for

immediate self-cleaning upon returning home (Gur, 2021; Zarrabi, Yazdanfar and Hosseini, 2021).

Given the rise in delivery, a drop-off zone for home deliveries seems necessary (Kaklauskas, et al., 2021). Coronaviruses can remain active on cardboard and plastic for three days (Zarrabi, Yazdanfar and Hosseini, 2021). Therefore, to avoid bringing the virus into the house, it is essential to have a disinfection area, such as a place to air out the package (Gur, 2021). A growing number of household appliances may need extra storage spaces for job documentation (Nanda, et al., 2021), supplies and goods, or food storage.

Meanwhile, WFH emphasises having a workplace at home. During lockdown times, employees had to prepare a pop-up workplace by converting their bedrooms, living rooms, and kitchens (Nanda, et al., 2021). Therefore, there is a new preference for "home office" or "Zoom Room" to create a quiet corner for concentration (Kaklauskas, et al., 2021). Gur (2021) recommended arranging at least one room as an office for work or schooling to ensure productivity.

Aside from that, there is a need for facilities that support physical activity at home. During the pandemic, a lack of recreational areas, green spaces, and walking paths negatively affected physical health (Gur, 2021). Rosa-Jimenez and Jaime-Segura (2022) indicated that most exercise is conducted in the living room or bedroom. Inadequate space in these places will pose a problem for stretching or violent motion. Hence, a dedicated or larger exercise space may be required inside the living unit if exercise cannot be conducted outdoors. Alternatively, physical activities can also be undertaken on a balcony or terrace (Cuerdo-Vilches, Navas-Martin and Oteiza, 2020).

On the other hand, open or semi-open areas, such as balconies, terraces, patios, outhouses and gardens, are essential for leisure and recreation (Akbari, et al., 2021) as well as socialisation and celebration (Peters and Halleran, 2020). A patio or balcony over a 6-metre square is desirable for activities (Bettaieb and Alsabban, 2021). A balcony or terrace provides a place for a view, engaging with nature and interacting with neighbours, thus enhancing the residents' mental comfort, sense of community, and well-being (Peters and Halleran, 2020).

2.3.5 Structural and Equipment Parameter

Since the pandemic, the utility and building design became vitally significant as people became more reliant on building systems and features. High-performance equipment ensures health and comfort and contributes to housing sustainability. Hence, structural and equipment parameter discusses the importance of technical aspects at home. The relevant mechanical and electrical systems involved are natural ventilation, natural daylighting, air conditioning, and sound insulation. Besides, this parameter also includes features regarding building materials and energy efficiency.

The virus-containing particles can spread through the air-conditioning system, posing a risk of Coronavirus transmission to residents (Peters and Halleran, 2020). As a result, D'Alessandro, et al. (2020) recommended optimising natural ventilation over mechanical systems. For example, installing operable windows and opening them more frequently can improve Indoor Air Quality (IAQ) and thermal comfort (D'Alessandro, et al., 2020). The natural ventilation system creates a more comfortable and healthier indoor environment. Nonetheless, it may be contrary in Malaysia, where the air conditioning system is highly dependent due to the extremely hot and humid weather conditions (Toosty, et al., 2022). Due to this, the air-conditioning system may be prioritised over the natural ventilation system in Malaysia.

The supply of natural light is also crucial for a healthy, sustainable housing environment. With a proper orientation to the sun and large windows, sunlight, natural heat, and light can be effectively utilised. Each room's light supply should be appropriate to the particular usage of the space. For example, lighting satisfaction in kitchens, living rooms and bedrooms are 175 lux, 150 lux and 200 lux, respectively. Also, the public space requires sufficient lighting, while the working area needs diffused natural lighting (D'Alessandro, et al., 2020). However, indoor energy dissipates when receiving solar heating, resulting in new technologies needed to mitigate energy loss (Zarrabi, Yazdanfar and Hosseini, 2021).

As a result of increased noise from neighbours during the lockdown, housing must be equipped with noise-reducing features (Nanda, et al., 2021). The home office and the rooms need to be acoustically separated in order to work comfortably (Peters and Halleran, 2020). In addition, the comfort zone can also be fitted with sound insulation materials on the walls. Moreover, installing green roofs or green walls

may also significantly reduce the amount of outdoor noise pollution (D'Alessandro, et al., 2020).

The COVID-19 pandemic may prompt the need for safe building materials for a healthier indoor environment. Materials containing high Volatile Organic Compounds (VOC) will emit a gas that harms human health when exposed to high temperatures. Therefore, an extended period of staying at home encourages the application of high-performance furnishings and finishing materials and low VOC materials (D'Alessandro, et al., 2020). Moreover, the Coronavirus can survive on the surface of materials or equipment for a few days (Zarrabi, Yazdanfar and Hosseini, 2021). Its spread can be prevented and intercepted with antibacterial and antiviral material. Nonetheless, regular cleaning and disinfection may overcome the remaining virus on the surface and reduce the importance of safe building materials.

During the pandemic, more energy-consuming activities were performed at home, including computing, working, and air-conditioning (Nanda, et al., 2021). The changed energy-consumption behaviour had costed higher electricity fees. Therefore, saving energy has become paramount to reducing living costs in homes, especially during economic downtime due to a pandemic (Zarrabi, Yazdanfar and Hosseini, 2021). As a result, houses with low energy fitting and appliances might be in demand.

2.3.6 Health and Comfort Parameter

Home indoor environments have a direct impact on mental and physical well-being. Amerio, et al. (2020) highlighted that poor indoor quality had led to discomfort in living, resulting in depression and anxiety during the lockdown. With more time spent at home than before, people may become more concerned about a healthy home and living comfort level. Consequently, this parameter consists of the housing quality related to health and comfort, including indoor environment quality (air quality, thermal comfort, acoustic quality and daylight quality) and mental comfort (view quality and spaciousness).

Thermal comfort and IAQ are conducive to health and comfort during the lockdown. A confined space may contain contaminants that could cause diseases, such as Sick Building Syndrome (SBS). Thus, sufficient fresh air, regular air exchange and good ventilation are essential for human health (D'Alessandro, et al., 2020), particularly in quarantined rooms and communal spaces like living rooms and kitchens (Zarrabi, Yazdanfar and Hosseini, 2021). Meanwhile, hot and damp living

conditions exacerbate the spread of Coronavirus. Living conditions with abnormally high or low temperatures will negatively affect health. Hence, it must also minimise interior thermal discomfort to promote health and productivity, especially in apartment units with many housing constraints (Peters and Halleran, 2020).

The quality of lighting and sound will have an impact on mental health. The lack of daylight exposure can influence residents' moods adversely. Therefore, it should ensure a minimum lighting standard to support living behaviour in each room. With more cooking and dining at home, optimal lighting in the kitchen is required (Peters and Halleran, 2020). Aside from that, noise severely impacts psychological health (Zarrabi, Yazdanfar and Hosseini, 2021). To enhance acoustic comfort, the noise level at home must not interfere with household activities such as sleeping, studying, and working (Peters and Halleran, 2020). In addition, there should be noise-free while a window is opened for ventilation or daylight.

Quality view and spaciousness improved mental comfort when outdoor activities were restricted. The exterior view provides a source of restoration to soothe the resident's minds and rejuvenate them from intense concentration. It is recommended to have windows look out over the neighbourhood, city streets, sky, and possibly nature (Peters and Halleran, 2020). There is also a need for open or semi-open space (Zarrabi, Yazdanfar and Hosseini, 2021), creating a sense of spaciousness and reducing oppression. In brief, both quality views and spaciousness contribute to mental relaxation, stress relief, mood-boosting, and illness healing, positively influencing mental health and comfort.

2.3.7 Green Parameter

Apart from housing quality and indoor comfort, the green elements and connection to nature play an essential role in enhancing physical and mental health. Besides, green elements can also mitigate climate impacts, thus benefiting the built environment and sustainability (D'Alessandro, et al., 2020). The green parameter refers to the green features that promote healthy living and energy efficiency. The green element could be the infrastructure incorporated into a building or having greenery adjacently, namely green space, green view, green infrastructure, gardens, and green plants in the living quarter.

Stay-at-home and social isolation policies during the COVID-19 pandemic have resulted in residents being isolated from the natural environment and having

limited access to green space (Peters and Halleran, 2020). Consequently, it negatively affects mental health, leading to depression and anxiety (Amerio, et al., 2020). Hence, the availability of green space is essential to reducing mental disorders arising from isolation and loneliness. It is recommended that each housing unit should have a visible and accessible green space following the pandemic. When green space is unavailable, the presence of a green view through windows or soft green plants in the living room will also be advantageous for well-being. It has been proved that viewing natural elements or landscapes can reduce stress, provide a sense of calm and foster healing, particularly for hospitalised patients (D'Alessandro, et al., 2020).

In addition to psychological aspects, the integration of green infrastructure into housing can maximise energy efficiency while increasing indoor comfort in the living environment. The green infrastructure can improve indoor air quality sound insulation and create a pleasing visual environment (Zarrabi, Yazdanfar and Hosseini, 2021). Green roofs, walls, and facades also increase the air humidity and reduce the indoor temperature, which allows the residents to stay at home for an extended period in comfort. Moreover, the provision of green walls and roofs minimises the need for air-conditioning in the summer, thus improving energy efficiency in the built environment (D'Alessandro, et al., 2020). However, the investment cost of green infrastructure is high (Zarrabi, Yazdanfar and Hosseini, 2021), which may subsequently affect its priority in housing preferences.

On the other hand, a place for gardening may be in greater demand in the post-COVID-19 era, such as nature yards, gardens, balconies or terraces. Gardening and growing plants as part of the horticultural therapy may reduce the symptoms of depression, anxiety, and dementia, which could help the state of mind during lockdown (D'Alessandro, et al., 2020; Akbari, et al., 2021; Kaklauskas, et al., 2021). Moreover, when dine-in is restricted, residents may plant organic produce in their gardens (Zarrabi, Yazdanfar and Hosseini, 2021) to adapt to their new habit of home cooking. Overall, a green element is likely to be one of the significant factors in determining housing preferences conducive to post-pandemic well-being.

2.3.8 Technological Parameter

In recent years, digital technology and automation have gained popularity, and this trend has accelerated due to the COVID-19 pandemic. Therefore, the technological

parameter is included in the potential housing preference. The technical parameter is regarded as the technology integrated with the housing, including the internet connection, security features and Smart Home technologies for automation, indoor comfort, and wellness.

The Internet connection is essential during the lockdown to access digital platforms for learning, working, entertaining, socialising, group chatting, and shopping (Nanda, et al., 2021). The availability and accessibility to the internet and wireless fidelity (Wi-Fi) have become a critical concern to stay connected to the world. The inadequate and poor-quality connectivity will adversely affect the quality of life, productivity, and living satisfaction. Meanwhile, the high level of simultaneous internet usage requires a more performant Internet technology system in a new home. For example, the fifth-generation wireless (5G) may be demanded to improve speed and responsiveness (D'Alessandro, et al., 2020).

Minimum touching and home disinfection are effective practices to prevent Coronavirus transmission. Therefore, a home automation system, known as Smart Home, will be a perfect solution for contactless and housekeeping services (D'Alessandro, et al., 2020; Kaklauskas, et al., 2021; Zarrabi, Yazdanfar and Hosseini, 2021). It provides contactless functionalities such as keyless entry, motion detection, controlled lighting and ventilation (Stolojescu-Crisan, Crisan and Butunoi, 2021). Besides, smart-cleaning toilets, bidets, and touchless appliances can facilitate the cleaning and disinfection process (Kaklauskas, et al., 2021). By setting and programming actions, household activities can be performed effortlessly.

Furthermore, residents need to adjust their natural or mechanical ventilation systems during pandemic outbreaks to maintain an optimal indoor temperature and humidity. With a Smart Home system, the residents are able to decrease the manual control and operation of the housing equipment and features. It enhances the quality of living by intelligently controlling the air quality, temperature, humidity, and air change rate. It also maximises energy efficiency since it will deactivate the unnecessary usage of lighting, heating, and cooling systems accordingly. This may lead to a higher demand for Smart Homes in larger homes (D'Alessandro, et al., 2020).

Aside from that, home quarantine is common due to the full capacity of hospitals. The patients may need assistance when quarantined in a separate room, especially the elderly and patients with severe symptoms. Smart Home control

system provides rapid response in case of emergency by equipping sensors, cameras and lifting facilities (D'Alessandro, et al., 2020). Moreover, the future Smart Home will provide personalised healthcare at home, such as behaviour and health monitoring, environment control, symptoms detection, telecare and others (Moreno, et al., 2017). Hence, these smart wellness features may be a new housing preference in response to the pandemic crisis.

In addition to that, the home security system may become necessary to safeguard the home. Security features such as an anti-theft system, fire prevention system (D'Alessandro, et al., 2020), security alarm system, closed-circuit television (CCTV) and concierge may be desired (Nanda, et al., 2021). Besides, a face lock is introduced as part of the intelligent home security system in the pandemic context. Combining autonomic and contactless capabilities, it ensures safety while simultaneously preventing the spread of viruses (Sethi, et al., 2021).

2.4 The Influence of Social Demographics on Housing Preferences

Depending on the homebuyers' background, their needs and preferences on housing attributes may differ significantly. The demographic factors generally reflect the characteristics of an individual as well as personal affordability and capability, which impact property purchase decisions (Majid, Said and Daud, 2012). Therefore, to comprehend the setting of housing preferences, it is essential to study the demographic factors driving homebuyers' behaviour, values, and psychographics that encourage their housing decisions. The demographic variables examined in this study are gender, age, ethnicity, marital status, household size, education level, and income level.

2.4.1 Gender

The differences between gender roles and behaviours will affect their preference for purchasing a house. Women are more interested in how a home fits their personal and family needs, relating the housing preferences to their lifestyle. Comparatively, men are more concerned with practical and logistical factors, such as accessibility to the workplace (Shawki, 2007). The gender differences in purchasing decisions were observed by Haddad, Judeh and Haddad (2011) and Majid, Said and Daud (2012), which included property attributes and surroundings. However, Mang, Zainal and

Radzuan (2018) stated that gender has little impact on housing location decisions in Iskandar Malaysia.

2.4.2 Age

Housing preferences differ over time based on the needs at that particular stage of life. There are distinctly different preferences between the older and younger generations, including housing designs, sense of belonging and housing features. For instance, most retirees prefer simple and classic homes, while youngsters are more likely to desire modern and contemporary home (Hei and Dastane, 2017). Additionally, the older generation values community interaction, security and comfort level (Ismail, et al., 2020), while the younger generation emphasises the financial and physical attributes of housing. In particular, the younger generation aged from 20 to 40 years old is highly concerned about financial factors in purchasing decisions (Bujang, et al., 2015; Khan, et al., 2017; Zamri, Yaacob and Suki, 2021).

2.4.3 Ethnicity

The cultural traditions and perspectives of diverse ethnic groups can profoundly affect their housing choice. Different ethnic groups have distinct preferences concerning housing location, environmental quality, and exterior features. For instance, individuals would value housing localities with proximity to their religious practices (Sinniah, et al., 2014). Moreover, Yap and Lum (2020) revealed that the orientation of external layout is the top priority for Chinese, second for Malays, and fifth for Indians. The living room arrangement is most concerned by Malays, while Indians prioritise street location. Furthermore, the Chinese emphasised the surrounding environment, external layouts, internal layouts, and interior arrangements as part of Feng Shui in pursuing good fortune and luck (Shafii, Yi and Yassin, 2020). On the other hand, Malays are inclined to have a dedicated prayer area at home for religious practices. Besides, Malay housewives greatly emphasise housing design, especially the size and colour of the kitchen they always utilise (Yuhaniz and Jusan, 2016).

2.4.4 Marital Status

Single, married, divorced, and widowed households have different housing requirements and family needs on purchasing a house. Indeed, marital status will influence the budget allocated to house purchasing (Hei and Dastane, 2017), affecting housing preferences. Marital status plays a significant role in the selection of build-up areas and housing locations. Abdullah, et al. (2012) and Soon and Tan (2019) demonstrated that married adults place high importance on the housing capacity for accommodating their children's needs. They prefer to live closer to schools to ease picking up and dropping off their children. Contrarily, unmarried adults may prefer to live close to their places of work. Moreover, the loss of a spouse will result in household relocation (Ismail, et al., 2020). However, Haddad, Judeh and Haddad (2011) found that marital status does not significantly affect the decision to purchase an apartment.

2.4.5 Household Size

Household size can be defined as the number of members in the household. Depending on their household size and the presence of children, family members have varying housing needs and preferences, such as house type, house size, and the number of rooms. For example, Soon and Tan (2019) observed that the larger household is concerned about the number of bedrooms. Besides, a bigger family prefers a location close to work because their routine is busier than small families. On the other hand, the proximity of schools and recreation parks is a top consideration for a household with children. In this way, households can conveniently send their children to school every weekday (Mang, Zainal and Radzuan, 2018). In addition, a simple design with plenty of space for movement attracts the family with kids (Majid, Said and Daud, 2012).

2.4.6 Education Level

With various education levels, individuals may have different financial capabilities, awareness of home purchasing, and needs in the housing system that influence their housing preferences (Majid, Said and Daud, 2012). Education is regarded as a means to improve earnings. A higher level of education is deemed to have higher household affordability in purchasing a home (Abdullah, et al., 2012). It encourages homebuyers to purchase a more expensive home located in a better neighbourhood

with superior housing quality. Moreover, (Mang, Zainal and Radzuan, 2018) revealed that higher educational qualifications are more concerned about proximity to work than those with lower educational qualifications. On the contrary, Haddad, Judeh and Haddad (2011) and Hei and Dastane (2017) concurred that the educational level has no significant influence on housing purchase decisions.

2.4.7 Income Level

Income level is always a determining factor in purchasing a house, as house price is high. It reflects an individual's ability to afford the desired home. Unfortunately, (Soon and Tan, 2019) highlighted that the monthly income is insufficient for Malaysians to purchase their preferred house at the current housing prices. There are significant differences between low-, medium- and high-income households in their choice of housing type. Bujang, Zarin and Jumadi (2010) stated that low-income homebuyers would probably purchase low-cost houses in the future, as they will be more concerned with the cost of housing when in a low-income or low-social-status situation. In contrast, homebuyers with higher income can buy properties at higher prices that best fit their needs and preferences. However, Mang, Zainal and Radzuan (2018) indicated that the income level is less significant concerning the location parameter.

2.5 Summary of Findings from Literature Review

The literature of relevant studies was reviewed, and a list of post-COVID-19 housing preferences was identified. Figure 2.1 illustrates the summary of key findings from the literature review. There are eight main parameters discovered for the post-COVID-19 housing preference, which are financial, locational, physical, space arrangement, structural and equipment, health and comfort, green and technological parameters. The eight parameters were further segregated into fifty-one factors which have been determined and supported by previous studies. Besides, figure 2.1 also illustrated the influence of the social demographic on housing preferences. The social demographic included as gender, age, ethnicity, marital status, household size, education level, and income level are identified to have influences on housing preferences.

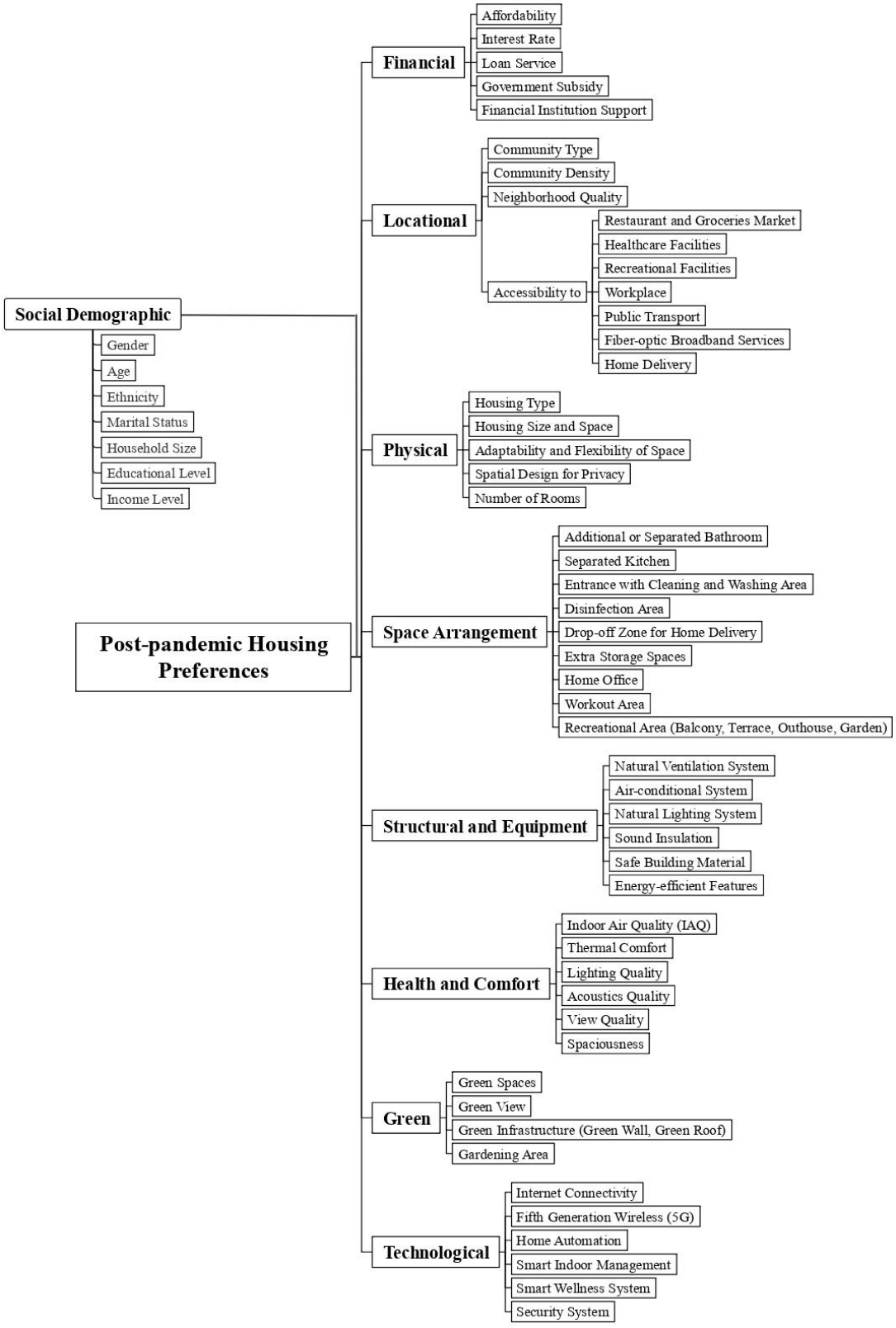

Figure 2.1: Summary of Key Findings from Literature Review.

2.6 Summary of Chapter

The definition of housing preference and factors triggering the shift of housing preferences were presented at the beginning of the chapter. It emphasised the importance of understanding housing preferences after the COVID-19 pandemic. Besides, each parameter for post-COVID-19 housing preferences was identified and explained in detail. In addition, the influence of social demographics on housing preferences was discussed. Lastly, this chapter ended with a summary of key findings on housing preferences in the aftermath of the COVID-19 pandemic.

CHAPTER 3

METHODOLOGY AND WORK PLAN

3.1 Introduction

This chapter outlines the research methodology of this study. The procedures for conducting a literature review are explained. Besides, the instrument for quantitative data collection is covered, including the questionnaire design, the sampling determination, and the distribution of questionnaires. Lastly, statistical tests for analysing data are discussed.

3.2 Research Method

The research methodology was defined by Creswell (2009) as procedures and planning to design and conduct research systematically. The selection of the research method depends on the nature of the study, the information required and the availability of resources (Kumar, Talib and Ramayah, 2012).

3.2.1 Quantitative Research Approach

Quantitative research is used to measure consumer behaviour, knowledge, opinions, or attitudes through surveys, questionnaires or structured interviews. It allows for testing the theory and hypothesis and enables the generalisation of the findings (Cooper and Schindler, 2014). Besides, quantitative research generates numerical and standardised data and analyses the data through tables, diagrams, and statistics to quantify trends and relationships in a large population (Saunders, Lewis and Thornhill, 2009).

Quantitative research has the advantage of being more reliable since its standardised procedures yield consistent results. Besides, the findings could be generalised to the entire population due to large-scale sampling. In addition, quantitative methods with larger sample sizes aid in providing robust analysis. Moreover, the quantitative approach with limited researcher involvement is less biased than qualitative data, which is subjective and susceptible to human error (Cooper and Schindler, 2014).

Despite its strengths, there are a few drawbacks of quantitative research. Quantitative research is unable to reveal underlying meaning and explanation as its

findings do not explain the reasons behind the effects and the meanings of social phenomena. The positivism of quantitative research cannot account for the factors that determine social reality and human interpretation. Further, it provides a broader overview of the variables rather than a deep dive. Since there is no connection with the participants, it is difficult for quantitative researchers to elicit the participants' perceptions and get feedback from them (Rahman, 2016).

3.2.2 Justification of Selection

This research aims to investigate housing preferences in Malaysia in the context of the COVID-19 pandemic. It is imperative to collect a wide range of numerical data to establish the overall trend of housing preferences among respondents from different social demographics. Hence, this study adopted the quantitative method as an appropriate approach to achieve the research objectives.

The quantitative design was chosen since it enables gathering a large amount of quantitative data via a questionnaire survey and reaching substantial respondents in a shorter period. Besides, the numerical data can then be analysed using Statistical Package for the Social Science (SPSS) software to rank the weights of preferences. Moreover, the results from large samples are able to generalise the preferences of the whole population. With this approach, all objectives related to investigating the housing preferences of homebuyers with diverse social demographics can be accomplished.

On the contrary, qualitative research is less suitable for this research as many respondents are needed. The small sample size and tendency to bias make it incompatible with this study. A small sample size will result in a lengthy process of collecting data via interview for each respondent. Considering the target respondents are homebuyers with different social demographics in Malaysia, a qualitative method that obtains data from a limited number of respondents with specific background tend to bias and is unable to represent the Malaysian population.

3.3 Literature Review

A literature review is a description and summary of the previous and contemporary data from journal articles, books, and other sources that are relevant to the research subject. This study followed the five steps of conducting a literature review as recommended by Creswell (2012).

The first step is identifying the key terms. For this study, the keywords used are "COVID-19 pandemic" with "housing", "housing preference" and "indoor built environment". The second step is locating literature by consulting several materials and databases related to the research topic. This study sourced the journals and articles from Science Direct, Research Gate, and Google Scholar and obtained the reference books from Google Books. Primary sources were primarily applied, including conference papers, journal articles, and books, with fewer secondary source literature reviews providing a good overview of the topic. The third step is critically evaluating and selecting the literature for the topic review. Housing preferences after the COVID-19 pandemic and lockdown are the priority of this study from numerous journals. Next, the fourth step is organising literature by abstracting and taking notes on the literature. As demonstrated in Figure 2.1, a literature map was presented to visualise the literature review. Lastly, the fifth step is writing the literature review.

3.4 Quantitative Data Collection

The survey strategy is selected for collecting quantitative data due to the fact that it gathers data more efficiently and economically, along with greater accuracy and is less subjective than direct interaction with respondents. Besides, a questionnaire is the most common method respondents familiar with and effectively surveys large populations (Sekaran and Bougie, 2016). The questionnaire design, sampling determination and questionnaire distribution are discussed further in the following section.

3.4.1 Questionnaire Design

Table 3.1 provided a summary of the questionnaire design. There were two sections in the questionnaire, Section A and Section B. Section A was designed to collect the respondents' demographic profiles to accomplish the third objective of the study, which is to investigate the influences of social demographic on post-COVID-19 housing preferences. Participants were requested to select their respective gender, age group, ethnicity, marital status, household status, education level and income level from a list of options in closed-ended and semi-ended questions.

In Section B, the respondents were requested to rank the importance of each housing preference after the COVID-19 pandemic. The purpose of Section B was to

evaluate the importance level of post-COVID-19 housing preferences to achieve objective two. The questions on post-COVID-19 housing preference were designed from eight parameters (financial, locational, physical, space arrangements, structural and equipment, health and comfort, green and technological). Furthermore, closed-ended questions with five-point Likert scale were adopted for the ranking, from 1 = not important, to 2 = less important, to 3 = moderately important, to 4 = very important, to 5 = extremely important. A sample questionnaire is attached at Appendix A.

Table 3.1: Questionnaire Design.

Section	Investigation Questions	Purposes
A	Demographic Information	i) To collect the respondents' demographic information. ii) To investigate demographic influences on post-COVID-19 housing preferences.
B	The importance of each housing preference after the COVID-19 pandemic.	To evaluate the importance level of post-COVID-19 housing preferences.

3.4.2 Pretesting of Questionnaire

Pretesting refers to assessing questions and instruments to discover the possibility of error and test the understandability and appropriateness of survey questions using a small number of respondents (Sekaran and Bougie, 2009). For this study, a pre-test was conducted prior to the main data collection. Six participants were involved, primarily academicians who belong to the Klang Valley homebuyer group. These six sets of questionnaires were excluded from the main analysis for the reason that a pre-test was intended to test the comprehensibility of the questionnaire design. The feedback gathered from pretesting was addressed to improve the survey design, including confusing statements, unclear meanings and language errors. The finalised questionnaires were then distributed to the target respondents.

3.4.3 Sampling Determination

A population is a group of individuals having the same characteristic, whereas a sample is a subgroup drawn from the target population to generalise the targeted population (Sekaran and Bougie, 2016). In simple words, a sample is representative of the whole targeted population. Therefore, sampling determination refers to identifying a small number of samples from a large population. The processes include specifying a population, selecting a sampling design, and determining sample size (Creswell, 2012). As the first step, the homebuyers in Klang Valley were selected as the population.

Secondly, convenience sampling was chosen to reach the targeted population. Generally, techniques of sampling can be divided into probabilistic and non-probabilistic. Probability sampling design provides a known or predetermined opportunity to be chosen for respondents, resulting in broader generalisability. In contrast, non-probability sampling is a widely used technique but does not involve a known or predetermined chance of selecting an individual (Sekaran and Bougie, 2016). To maximise the response rate from individuals with diverse demographic backgrounds, convenience sampling as a non-probability sampling method was selected. It aids in recruiting a large number of respondents who are easily accessible by researchers, including family and friends.

Thirdly, the Cochran formula and Central Limit Theorem (CLT) were applied to determine the sample size. According to the rule of thumb, the sample should be as large as possible to reduce the error possibility of the sample being different from the whole population (Creswell, 2012). The Cochran formula suggests that a minimum sample size of three hundred and eighty-four can be considered a reasonable degree of accuracy. The sample size was obtained and expressed using the equation below (Cochran, 1977):

$$n = \frac{Z^2 pq}{e^2} \tag{3.1}$$

where

n = sample size

z = the z-scores of the desired confidence level

p = the proportion of the population with attributes understudy

q = 1- p

e = the margin of error

This study assumed a 95% confidence level, and the z-score was derived as 1.96. The p-value was 0.05, while the margin of error was set as 5%. Hence, the sample size was determined:

$$n = \frac{1.96^2(0.5)(1-0.5)}{0.05^2} = 384$$

Nevertheless, CLT with thirty samples was applied instead of a large sample size of three hundred and eighty-four. CLT holds that as the sample size increases, the sample mean will be closer to the mean of the whole population, regardless of its actual data distribution (Cooper and Schindler, 2014). In other words, the average sample mean will reflect the actual population mean. A sample size of thirty or more is adequate to represent an approximately normal distribution, which means that thirty samples are valid and reliable for representing a majority of the population. Hence, CLT was applied to understand the characteristics of each demographic profile.

3.4.4 Questionnaire Distribution

Electronic and paper surveys were adopted to reach a larger sample of homebuyers in the Klang Valley over the age of twenty-one. After sampling determination and questionnaire design, an electronic questionnaire was created using Google Forms. The survey link was then distributed to the target respondents via social media posts and chats on LinkedIn, Facebook, and Instagram.

However, an online questionnaire has the drawback of having a biased sample, as internet users tend to be a younger, better educated, and wealthier population (Bryman and Bell, 2011). A paper survey was therefore conducted to reach respondents unfamiliar with the internet. The hardcopy survey was printed out and distributed by hand at shopping malls, bus stations and train stations, where a broad range of respondents of diverse demographics could be reached. In brief, it took about six weeks to distribute the questionnaires and collect the data.

3.5 Data Analysis

Data analysis involves the systematic description, analysis, and evaluation of the collected data. The raw data were converted into useful information, and relationships between data were then established to produce survey results. In this study, the SPSS software was employed to run the four statistical tests, namely Cronbach's Alpha Reliability Test, Friedman Test, Mann-Whitney U Test and Kruskal-Wallis Test.

3.5.1 Cronbach Alpha Reliability Test

Cronbach's Alpha Reliability test is generally used in Likert-scaled-based questions to assess the internal consistency or reliability of the scale. Scores between 0 and 1 will be generated. A higher Cronbach's alpha value provides greater internal consistency with a lower error rate. In other words, the higher alpha value indicates that the variables are highly correlated, whilst a low value implies that the variables do not reflect the research objective. Cronbach's alpha value equal to or greater than 0.7 is considered acceptable, and less than 0.5 is unacceptable (Tavakol and Dennick, 2011). In this study, Cronbach's Alpha Reliability test was used to test the internal consistency of the important level of post-COVID-19 housing preference.

3.5.2 Friedman Test

Friedman test is a non-parametric test conducted to analyse whether there are significant differences between three or more ordinal dependent samples. It determines the variance by ranks, thus enabling ranking within the same groups of subjects (Gabor, 2012). In this study, this test was used to rank participants' response on the importance level of post-COVID-19 housing preferences. Hence, it allows evaluating and comparing the importance level of different housing preferences.

To examine the significant differences between the important level of post-COVID-19 housing preferences, the null hypothesis (H_0) and alternative hypothesis (H_1) were formulated:

H_0 : There are no significant differences between the importance level of post-COVID-19 housing preferences.

H_1 : There are significant differences between the importance level of post-COVID-19 housing preferences.

3.5.3 Mann-Whitney U Test

Mann-Whitney U test is a non-parametric test used to determine whether there are statistical differences between two independent groups (Milenovic, 2011), enabling the comparison of differences in the same population. Homebuyers from different social demographic groups will have various opinions and concerns regarding housing preferences. Hence, the goal of the test is to examine the differences in housing preferences across various social demographics.

In this study, the dependent variable is "factors influencing housing preferences", whereas the independent variables are the demographic profiles of homebuyers such as “gender”, and “marital status”, “household size”, “income level”. To evaluate the differences between independent and dependent variables, the null hypothesis (H_0) and alternative hypothesis (H_1) were developed as below:

H_0 : There is no significant difference across the social demographic of homebuyers on the post-COVID-19 housing preferences.

H_1 : There is a significant difference across the social demographic of homebuyers on the post-COVID-19 housing preferences.

3.5.4 Kruskal-Wallis Test

Kruskal-Wallis test is a non-parametric test performed to determine significant differences between two or more independent variables on ordinal or continuous dependent variables (Ostertagova, Ostertag and Kovac, 2014), providing the comparison of differences between groupings. This study applied the Kruskal-Wallis test to analyse differences in housing preferences among different demographic backgrounds. The independent variables are “ethnicity”, “age”, and “education level”.

The H-value was compared with the critical Chi-square value to establish the hypothesis for the calculation. The null hypothesis (H_0) is rejected if the critical chi-square value is less than the H-value, while if the critical chi-square value is higher than the H-value, the null hypothesis is failed to reject. To determine the significant difference between the demographic profiles, the null hypothesis (H_0) and alternative hypothesis (H_1) were established:

H_0 : There is no significant difference across the social demographic of homebuyers on the post-COVID-19 housing preferences.

H_1 : There is a significant difference across the social demographic of homebuyers on the post-COVID-19 housing preferences.

3.6 Summary of Chapter

In summary, this study adopted the quantitative method as it is beneficial in achieving the research objectives. The questionnaire survey was conducted to collect data among homebuyers in Klang Valley over the age of twenty-one. CLT was used to determine the sample size, and convenience sampling was utilised for selecting respondents. Finally, SPSS was performed to analyse the collected data. The applied statistical tests were Cronbach's Alpha Reliability Test, Friedman Test, Mann-Whitney U Test and Kruskal-Wallis Test. The finding will be further discussed in the subsequent chapters.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter analyses the findings of the survey data. It begins with a summary of respondents' demographic profiles, followed by a reliability analysis of the data using Cronbach's Alpha Reliability Test. Next, the Friedman test was applied to rank the importance level of housing preferences, while Mann-Whitney U Test and Kruskal-Wallis Test were adopted to determine the significant differences in post-COVID-19 housing preferences between diverse social demographics.

4.2 Demographics of Respondents

A total of 145 responses were received, 109 from the e-survey and 36 from the paper survey. However, 4 responses were excluded as 3 respondents are non-Malaysians and 1 respondent is under 21 years old. Hence, 141 qualified responses were included and analysed in this study. Table 4.1 displays the demographics of survey respondents as frequencies and percentages.

Table 4.1: Summary of Respondents' Demographics.

Demographic	Category	Frequency (n)	Percentage (%)
Gender	Male	60	42.6
	Female	81	57.4
Ethnicity	Chinese	74	52.5
	Malay	33	23.4
	Indian	34	24.1
Age	21 years old to 30 years old	73	51.8
	31 years old to 40 years old	35	24.8
	41 years old to 50 years old	20	14.2
	51 years old and above	13	9.2
Marital Status	Single	79	56.0
	Married	62	44.0
Household Size	Household with children	54	38.3
	Household without children	87	61.7
	Living alone	6	4.3
	Living with 1 person	9	6.4

Table 4.1 (Cont'd)

Demographic	Category	Frequency (n)	Percentage (%)
Household Size	Living with 2 people	11	7.8
	Living with 3 people	35	24.8
	Living with 4 people	32	22.7
	Living with 5 people	28	19.9
	Living with 6 people	11	7.8
	Living with 7 people	7	5.0
	Living with 8 people	2	1.4
Educational Level	High school	23	16.3
	Foundation / A-Level / STPM / UEC	7	5.0
	Diploma	12	8.5
	Bachelor's Degree	66	46.8
	Master's Degree	29	20.6
	Doctorate	4	2.8
Income Level	RM 4,849 and below (B40)	83	58.9
	RM 4,850 to RM 10,959 (M40)	45	31.9
	RM 10,960 and above (T20)	13	9.2

As shown in Table 4.1, there are 42.6% male and 57.4% female respondents. Among the respondents, 52.5% are Chinese, followed by 23.4% of Malay and 24.1% of Indians. Regarding the age group, 51.8% of respondents are between 21 and 30 years of age, followed by 24.8% between 31 and 40 years old. In addition, 14.2% and 9.2% of respondents belong to the 41 to 50 years old and 51 years old and above, respectively.

With regard to marital status, it is reported by 56.0% of respondents are single, compared to 44.0% of respondents who are married. There is 38.3% of households with children and 61.7% without children. Besides, referring to household size, 6 live alone, 9 live with 1 person, 11 with 2 people, 35 with 3 people, 32 with 4 people, 28 with 5 people, 11 with 6 people, 7 with 7 people and 2 with 8 people.

In terms of educational level, a high school certificate is held by 16.3% of respondents, a foundation level, A-Level, STPM, and UEC by 5.0%, a diploma by 8.5%, a bachelor's degree by 46.8%, a master's degree by 20.6%, and a doctorate by 2.8%. Moving on to the current monthly income, the majority of the respondents are B40 with earning RM 4,849 and below, which comprises 58.9%. M40 with a

monthly income level of RM 4,850 to RM 10,959 represents 31.9%, while T20 with a monthly income of RM 10,960 and above represents 9.2%.

4.3 Cronbach's Alpha Reliability Test

Table 4.2 shows the results of a reliability test on post-COVID-19 housing preferences. All parameters have achieved a Cronbach's Alpha value of more than 0.70. It is therefore considered acceptable, indicating internal consistency among the construct of testing items (Tavakol and Dennick, 2011). With 0.960 exceeding the acceptable value, it provides an excellent data set that is highly reliable and has good internal consistency for further analysis.

Table 4.2: Reliability Statistics of Post-COVID-19 Housing Preferences.

Parameter	Cronbach's Alpha	Number of Items
Financial	0.869	5
Locational	0.872	10
Physical	0.822	5
Spatial Arrangement	0.900	9
Structural and Equipment	0.872	6
Health and Comfort	0.896	6
Green	0.914	4
Technological	0.899	6
Total	0.960	51

4.4 Friedman Test

The mean ranks of the importance level of eight main parameters and fifty-one post-COVID-19 housing preferences are examined and compared with the Friedman Test. Additionally, Friedman Test evaluates whether there was an overall statistically significant difference between the mean ranks of the post-COVID-19 housing preferences.

4.4.1 Overall Mean Ranking of Post-COVID-19 Housing Preferences

Table 4.3 illustrates the overall mean ranking of the post-COVID-19 housing preferences based on the eight main parameters. The parameter with the highest mean value represents an aspect that is highly significant to homebuyers in their home purchasing decisions in the aftermath of the COVID-19 pandemic.

Table 4.3: Overall Mean Ranking of Post-COVID-19 Housing Preferences.

Ranking	Code	Parameters	Mean Rank
1	F	Health and Comfort	30.03
2	A	Financial	28.09
3	E	Structural and Equipment	27.35
4	B	Locational	26.88
5	H	Technological	26.14
6	C	Physical	25.42
7	D	Spatial Arrangement	22.90
8	G	Green	20.60

Referring to Table 4.3, the "health and comfort parameter" (F) has the highest mean ranking of 30.03. It reveals that a healthier and more comfortable living is more desirable to Malaysian homebuyers in the post-pandemic era. The reason is that humans have taken health risk factors more seriously and are more aware of the importance of wellness since the pandemic (Kolakowski, et al., 2021). In addition, human beings' awareness of the relationship between living environment and physical and psychological health has been growing after suffering from poor housing conditions and quality during the lockdown period. Consequently, health and comfort in housing are important for a new healthy lifestyle after the COVID-19 pandemic.

The next parameter is the "financial parameter" (A), with a mean value of 28.09. It is apparent that financial factors, which were always the top consideration in home purchasing before the outbreak, remain emphasised by Malaysian homebuyers after the pandemic. This is owing to Malaysians' low affordability and insufficient income prior to the pandemic (Soon and Tan, 2019) and worsening economic recession, unemployment, and salary cuts during the pandemic (Muhyi and Adianto, 2021). The financial parameter is, therefore, a major consideration for Malaysians when purchasing a home. Despite this, Malaysians place less importance on financial parameters than health and comfort aspects when it comes to death and loss caused by COVID-19 health impacts.

The least remarkable parameter is the "green parameter" (G), with the lowest mean value of 20.60. It implied that Malaysian homebuyers gave green aspects the least attention as compared to the other parameters after the pandemic. This is because there was a lack of knowledge, information and understanding of the benefits of green features to the public in Malaysia (Lim, Tan and Hambira,

2018). Hence, Malaysians might overlook the green aspect when purchasing a home that could contribute to their mental health. Further, integrating green features involves a cost that homebuyers might not be willing to pay during times of crisis. In this respect, it is not surprising that Malaysians place a low priority on the green parameter compared to the aspects that had primarily affected Malaysians physically and financially amidst the pandemic.

4.4.2 Mean Ranking of Post-COVID-19 Housing Preferences

Two hypotheses are generated for this test:

Null hypothesis (H_0): There are no significant differences between the fifty-one post-COVID-19 housing preferences.

Alternative hypothesis (H_1): There are significant differences between the fifty-one post-COVID-19 housing preferences.

Table 4.4: Friedman Test on Post-COVID-19 Housing Preferences.

Number of Items	Chi-Square	Degree of Freedom	Asymptotic Significance
51	583.347	50	<.001

Table 4.4 depicts the Friedman Test result in which the p-value is lesser than 0.05, rejecting the null hypothesis (H_0). Hence, there were statistically significant differences in the perceived importance level of the post-COVID-19 housing preferences. Besides, the mean rank of the fifty-one post-COVID-19 housing preferences are ranked and tabulated in Table 4.5. The housing preferences with a higher mean rank denote having a higher importance level to the homebuyers and will be influential in house purchasing after the pandemic.

Table 4.5: Mean Ranking of Post-COVID-19 Housing Preferences.

Ranking	Code	Post-COVID-19 Housing Preferences	Mean Rank
1	F4	Acoustics Quality	33.06
2	H1	Internet Connectivity	32.79
3	F1	Indoor Air Quality (IAQ)	32.63
4	B7	Accessibility to Workplace	30.75
5	B9	Accessibility to Fibre-optic Broadband Services	30.71
6	A1	Affordability	30.35

Table 4.5 (Cont'd)

Ranking	Code	Post-COVID-19 Housing Preferences	Mean Rank
7	H2	Fifth Generation Wireless (5G)	29.92
8	F3	Lighting Quality	29.73
9	B3	Neighbourhood Quality	29.70
10	H6	Security System	29.32
11	F2	Thermal Comfort	29.13
12	B4	Accessibility to Restaurant and Groceries Market	29.03
13	B5	Accessibility to Healthcare Facilities	29.02
14	F6	Spaciousness	28.97
15	E3	Natural Lighting System	28.95
16	C4	Spatial Design for Privacy	28.61
17	A3	Loan Service	28.59
18	A2	Interest Rate	28.49
19	E1	Natural Ventilation System	28.02
20	E5	Safe Building Material	27.67
21	E4	Sound Insulation	27.57
22	A5	Financial Institution Support	27.29
23	F5	View Quality	26.65
24	E6	Energy-efficient Features	26.26
25	B1	Community Type	25.87
26	A4	Government Subsidy	25.73
27	E2	Air-conditional System	25.64
28	C2	Housing Size and Space	25.55
29	D1	Additional or Separated Bathroom	25.42
30	B10	Accessibility to Home Delivery	25.17
31	C5	Number of Rooms	25.04
32	D7	Home Office	24.41
33	C1	Housing Type	24.34
34	D6	Extra Storage Spaces	24.16
35	B2	Community Density	23.99
36	D3	Entrance with Cleaning and Washing Area	23.77
37	C3	Adaptability and Flexibility of Space	23.55
38	H3	Home Automation	22.78
39	D9	Recreational Area (Balcony, Terrace, Outhouse, Garden)	22.55
40	B6	Accessibility to Recreational Facilities	22.33
41	B8	Accessibility to Public Transport	22.26
42	G1	Green Spaces	22.11
43	D2	Separated Kitchen	21.96
44	D5	Drop-off Zone for Home Delivery	21.88
45	D4	Disinfection Area	21.52
46	H4	Smart Indoor Management	21.49
47	G4	Gardening Area	21.21

Table 4.5 (Cont'd)

Ranking	Code	Post-COVID-19 Housing Preferences	Mean Rank
48	G2	Green View	20.86
49	H5	Smart Wellness System	20.56
50	D8	Workout Area	20.46
51	G3	Green Infrastructure (Green Wall, Green Roof)	18.21

According to Table 4.5, the housing preference with the highest mean ranking is **F4** = "Acoustic Quality" under "health and comfort parameter", with a mean value of 33.06. As Malaysians stayed, studied and worked from home during MCO, there was a greater requirement for acoustic quality while spending more time at home. The ability to concentrate and productivity were affected adversely due to the increasingly annoying neighbour noise from talking, television and home appliances during the lockdown period (Lee and Jeong, 2021). Meanwhile, continuous noise disturbance and interference caused the occupants' mental issues due to difficulty in controlling noise sources to the acceptance level. Consequently, a noise-free environment is prioritised by Malaysians after the pandemic to avoid unnecessary disturbance and to enhance mental comfort. In accordance with Zarrabi, Yazdanfar and Hosseini (2021), residents placed a relatively high emphasis on acoustics quality among environmental preferences during the pandemic.

The second highest mean ranking is **H1** = "Internet Connectivity" under "technological parameter", with a mean value of 32.79. The COVID-19 pandemic has been a catalyst for the implementation of digital technologies and the reliance on the Internet. It is essential for Malaysians to access the Internet at home to keep pace with the times, obtain information, perform daily activities and connect to the social environment. Accordingly, in the absence of internet connectivity, productivity and efficiency in most home activities will be affected, as well as the quality of life and living satisfaction. Hence, connecting to the Internet is of utmost importance for Malaysians in the digitalisation society, particularly after the pandemic when mobile phones and laptops have become a necessity for daily life activities. Similar to D'Alessandro, et al. (2020) and Nanda, et al. (2021), these studies also suggested that the presence of internet and Wi-Fi networks will be an important consideration for homebuyers in post-pandemic society.

The third highest mean ranking also comes from the group "health and comfort parameter", which is **F1** = "Indoor Air Quality (IAQ)" with a mean value of

32.63. During MCO, Malaysians were forced to stay at home with activities restricted in housing spaces and limited airflow. As more activities were conducted at home, indoor air pollution increased accordingly (Ezani, et al., 2021). Thus, a long period of exposure to indoor air pollutants led to physical health, such as asthma, respiratory infection, heart disease, stroke, and more severely affected COVID-19 patients who were afflicted with a respiratory syndrome, and being worse, death. In addition, airflow plays a vital role in ventilating air and preventing the spreading of the disease at home. Therefore, good indoor air quality has been given priority by Malaysians due to health and safety concerns, with increased time spent indoors than before the pandemic. Similarly, Akbari, et al. (2021) exhibited that indoor air quality is the most critical preference among the environmental factors during the pandemic, surpassing acoustic quality, the highest ranked housing preference in this study.

The second lowest mean ranking is **D8** = "Workout Area" under "spatial arrangement parameter", with a mean value of 20.46. This result revealed that having an indoor workout area is not a key consideration of Malaysian homebuyers in home purchasing compared with other housing preferences. This could be explained by the fact that exercising in indoor spaces significantly impacted residents' mental health during the outbreak, as revealed by Akbari, et al. (2021). The study found that residents who exercised outdoors had better mental health conditions than those who exercised indoors. Hence, outdoor exercise is more likely to affect homebuyers' satisfaction with enjoying physical activity than indoor workouts. In consequence, homebuyers are less concerned with having an indoor workout area for a new home.

The lowest mean ranking of the housing preference is **G3** = "Green Infrastructure (Green Wall, Green Roof)", which is categorised under the "green parameter" with a mean value of 18.21. The ranking can be attributed to the fact that the green concept is still a new norm in Malaysia. There is a lack of awareness among Malaysians of how green technology can benefit them in terms of improving housing quality and warding off Coronavirus during the pandemic. Further, green infrastructure, elements, and technologies are more costly than conventional features, resulting in higher upfront costs (Ong, Yusof and Osmadi, 2021). Therefore, green infrastructure has the Malaysians' lowest priority in the post-pandemic era due to a lack of awareness and budget. Nevertheless, the results of this study contradicted with research from Kaklauskas, et al. (2021) who predicted that green housing will be in demand in Switzerland after the COVID-19 pandemic.

4.5 Mann-Whitney U Test

Mann-Whitney U test is adopted to identify the significant differences in the post-COVID-19 housing preferences between different gender, marital status, household size and income level of homebuyers. A p-value of 0.05 is used as a threshold of significance.

4.5.1 Mann-Whitney U Test on Gender

Two hypotheses are formulated as below:

Null hypothesis (H_0): There is no significant difference between male and female homebuyers in the post-COVID-19 housing preferences.

Alternative hypothesis (H_1): There is a significant difference between male and female homebuyers in the post-COVID-19 housing preferences.

Table 4.6: Mann-Whitney U Test on Gender.

Code	Post-COVID-19 Housing Preferences	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
B10	Accessibility to Home Delivery	1874	3704	-2.416	0.016
D1	Additional or Separated Bathroom	1812	3642	-2.699	0.007

Table 4.6 illustrates the Mann-Whitney U test result on gender. It revealed that two post-COVID-19 housing preferences consist of a p-value less than 0.05. The two housing preferences are **B10** = "Accessibility to Home Delivery" and **D1** = "Additional or Separated Bathroom". The result concludes that males and females perceive housing preferences significantly differently. Hence, the null hypothesis (H_0) is rejected for these two housing preferences.

Table 4.7: Mean Rank of Post-COVID-19 Housing Preferences across Gender.

Code	Post-COVID-19 Housing Preferences	Gender	N	Mean Rank	Sum of Ranks
B10	Accessibility to Home Delivery	Male	60	61.73	3704.00
		Female	**81**	**77.86**	**6307.00**
D1	Additional or Separated Bathroom	Male	60	60.70	3642.00
		Female	**81**	**78.63**	**6369.00**

Note: **Bold** indicates the highest mean rank

Females have a higher mean rank than males in two housing preferences, as shown in Table 4.7. It indicates that females prefer houses that online delivery services could access to enjoy convenience and houses with additional bathrooms to facilitate the queue for washrooms and enable quarantine of infected individuals. In accordance with Haddad, Judeh and Haddad (2011) and Majid, Said and Daud (2012), housing preferences differ significantly between genders. There is evidence that females enjoy online shopping (Lim, et al., 2019) and bathe more frequently (Smith, 2016) than their male counterparts. Due to the female nature of relating their lifestyles to their homes (Shawki, 2007), they tend to integrate these two post-pandemic ways of living into their housing environment to ease online shopping and bathing, thus placing higher importance levels than males in these two housing preferences after the pandemic.

4.5.2 Mann-Whitney U Test on Marital Status

There are two hypotheses formulated as follows:

Null hypothesis (H_0): There is no significant difference between single and married homebuyers in the post-COVID-19 housing preferences.

Alternative hypothesis (H_1): There is a significant difference between single and married homebuyers in the post-COVID-19 housing preferences.

Table 4.8: Mann-Whitney U Test on Marital Status.

Code	Post-COVID-19 Housing Preferences	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
B10	Accessibility to Home Delivery	1894.5	3847.5	-2.401	0.016
C1	Housing Type	1964	5124	-2.105	0.035

The Mann-Whitney U test result on marital status is tabulated in Table 4.8. It exhibits two post-COVID-19 housing preferences with a p-value less than 0.05. These housing preferences are **B10** = "Accessibility to Home Delivery" and **C1** = "Housing Type". The results depict that single and married homebuyer perceives housing preferences significantly differently. It rejects the null hypothesis (H_0) for these two housing preferences.

Table 4.9: Mean Rank of Post-COVID-19 Housing Preferences across Marital Status.

Code	Post-COVID-19 Housing Preferences	Marital Status	N	Mean Rank	Sum of Ranks
B10	Accessibility to Home Delivery	**Single**	**79**	**78.02**	**6163.50**
		Married	62	62.06	3847.50
C1	Housing Type	Single	79	64.86	5124.00
		Married	**62**	**78.82**	**4887.00**

Note: **Bold** indicates the highest mean rank

Table 4.9 indicated that single homebuyers rank higher in accessibility to home delivery, while married homebuyers rank higher in housing type. This is inconsistent with Haddad, Judeh and Haddad (2011), which stated that marital status does not significantly influence housing purchasing. Typically, single homebuyers prioritise their own needs above those of their families whereas the preference of married households is more geared toward family-oriented functionality. Compared to married households, single homebuyers might avoid extended periods of spending outdoor alone during the pandemic, leading to a greater demand for home delivery services.

Apart from that, a similar finding was made by Majid, Said and Daud (2012) who proved that there is a significant difference between marital status referring to housing type. Couples would consider stability in the long-term decision (Hurtubia, Gallay and Bierlaire, 2010). Understandably, housing type is one of the crucial factors to married homebuyers for a stable life. Owning healthy and long-lasting housing is especially significant after the pandemic to prevent living at high risk of Coronavirus infection. Thereby, married households place more emphasis on housing type than single homebuyers who may relocate after a while to adjust to their career and living circumstances.

4.5.3 Mann-Whitney U Test on Household Size

Two sets of data were collected to understand the influence of household size on housing preferences, including the presence of children and the number of people occupying a housing unit. First, the difference in post-COVID-19 housing preferences between households with and without children is evaluated.

Two hypotheses are set as stated:

Null hypothesis (H_0): There is no significant difference in the post-COVID-19 housing preferences between households with and without children.

Alternative hypothesis (H_1): There is a significant difference in the post-COVID-19 housing preferences between households with and without children.

Table 4.10: Mann-Whitney U Test on the Presence of Children.

Code	Post-COVID-19 Housing Preferences	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
A2	Interest Rate	1819	5647	-2.402	0.016
B2	Community Density	1753	5581	-2.635	0.008
B3	Neighbourhood Quality	1866.5	5694.5	-2.188	0.029
C1	Housing Type	1740	5568	-2.698	0.007

Based on the Mann-Whitney U test result on the presence of children presented in Table 4.10, four post-COVID-19 housing preferences have a p-value less than 0.05. They are **A2** = "Interest Rate", **B2** = "Community Density", **B3** = "Neighbourhood Quality" and **C1** = "Housing Type". According to the result, households with and without children perceive housing preferences differently. The null hypothesis (H_0) is therefore rejected by these four housing preferences.

Table 4.11: Mean Rank of Post-COVID-19 Housing Preferences across the Presence of Children.

Code	Post-COVID-19 Housing Preferences	Number of Children	N	Mean Rank	Sum of Ranks
A2	Interest Rate	**Household with children**	**54**	**80.81**	**4364.00**
		Household without children	87	64.91	5647.00
B2	Community Density	**Household with children**	**54**	**82.04**	**4430.00**
		Household without children	87	64.15	5581.00
B3	Neighbourhood Quality	**Household with children**	**54**	**79.94**	**4316.50**
		Household without children	87	65.45	5694.50
C1	Housing Type	**Household with children**	**54**	**82.28**	**4443.00**
		Household without children	87	64.00	5568.00

Note: **Bold** indicates the highest mean rank

Table 4.11 indicates that households with children rank higher in post-COVID-19 housing preferences on the interest rate, community density,

neighbourhood quality and housing type. In agreement with Majid, Said and Daud (2012) and Mang, Zainal and Radzuan (2018), their results also showed a significant difference between households with and without children. This is because the former would include children's needs in home purchasing considerations. Firstly, the interest rate is crucial for a family with children. As part of the financial planning of a household, the children's expenses are accounted for in the fund allocation for home purchasing (Hei and Dastane, 2017). Therefore, a higher interest rate might increase the burden on child-bearing homebuyers to pay a higher monthly instalment while responsible for the costs of bringing up children.

The results of this study are also compatible with findings from Opoku and Abdul-Muhmin (2010) that a good housing environment is vital for households with children for childhood development. Having a neighbourhood that is tranquil, secure, and close to nature is conducive to raising children. Due to the vulnerability of children to Coronavirus infection, a less crowded community and low-density housing types, such as landed housing, are favoured by parents to protect their children from diseases. In addition, children could also be active and move around freely in a land house (Majid, Said and Daud, 2012), when outdoor activities were restricted during the pandemic. Consequently, a child-friendly environment is a top priority for a household with children than without children.

Meanwhile, the differences in post-COVID-19 housing preferences are examined across households with varying numbers of people living together in a residential unit. To fulfil Central Limit Theorem (CLT) for significant analysis, an individual living alone or with up to three people is grouped as household size "less than or equal to 3", whilst living with four to eight people is categorised as household size "greater than 3". Then, the differences between household size with "less than or equal to 3" and "greater than 3" are evaluated.

There are two hypotheses generated below:

Null hypothesis (H_0): There is no significant difference in the post-COVID-19 housing preferences between the household size of less than or equal to three and greater than three.

Alternative hypothesis (H_1): There is a significant difference in the post-COVID-19 housing preferences between the household size of less than or equal to three and greater than three.

Table 4.12: Mann-Whitney U Test on Number of Occupants.

Code	Post-COVID-19 Housing Preferences	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
C5	Number of Rooms	1789	3680	-2.870	0.004
D2	Separated Kitchen	1974	3865	-2.009	0.044
D8	Workout Area	1878	3769	-2.439	0.015
D9	Recreational Area (Balcony, Terrace, Outhouse, Garden)	1911	3802	-2.307	0.021
E1	Natural Ventilation System	1790.5	5030.5	-2.859	0.004

In Table 4.12, the Mann-Whitney U test on the number of occupants demonstrates that five post-COVID-19 housing preferences have a p-value of less than 0.05. The five housing preferences include **C5** = "Number of Rooms", **D2** = "Separated Kitchen", **D8** = "Workout Area", **D9** = "Recreational Area (Balcony, Terrace, Outhouse, Garden)", **E1** = "Natural Ventilation System". It displays a significant difference in housing preferences between household sizes less than or equal to three and greater than three. Briefly, the null hypothesis (H_0) is rejected for these five housing preferences.

Table 4.13: Mean Rank of Post-COVID-19 Housing Preferences across Number of Occupants.

Code	Post-COVID-19 Housing Preferences	Household Size	N	Mean Rank	Sum of Ranks
C5	Number of Rooms	Less than or equal to 3	61	60.33	3680.00
		Greater than 3	**80**	**79.14**	**6331.00**
D2	Separated Kitchen	Less than or equal to 3	61	63.36	3865.00
		Greater than 3	**80**	**76.83**	**6146.00**
D8	Workout Area	Less than or equal to 3	61	61.79	3769.00
		Greater than 3	**80**	**78.03**	**6242.00**
D9	Recreational Area (Balcony, Terrace, Outhouse, Garden)	Less than or equal to 3	61	62.33	3802.00
		Greater than 3	**80**	**77.61**	**6209.00**
E1	Natural Ventilation System	**Less than or equal to 3**	**61**	**81.65**	**4980.50**
		Greater than 3	80	62.88	5030.50

Note: **Bold** indicates the highest mean rank

Table 4.13 found that bigger households are given more attention to post-COVID-19 housing preferences than smaller households on the number of rooms, separated kitchens, workout areas, recreational areas and natural ventilation systems. While the installation of natural ventilation systems is preferred by smaller households. There might be due to an air-conditioning system applied more frequently during the pandemic in Malaysia (Toosty, et al., 2022) that makes electrical expenses higher for personal usage in a smaller household. Hence, a smaller household size would desire the use of a natural ventilation system.

On the other hand, the finding showed that bigger households place more emphasis on the number of rooms and the spatial arrangement parameters. Clearly, a larger household size dictates a greater need for housing space (Hurtubia, Gallay and Bierlaire, 2010). Thus, it is crucial to have a dedicated space in a big household family to conduct events without sharing the place, including a separate kitchen, workout area and recreation space. Besides, as discovered by Soon and Tan (2019), the bigger the household, the more rooms needed. This holds particular importance for larger households after experiencing lockdown and crowded living when all household members were staying at home and more isolated rooms were required for each individual to ensure effective quarantine.

4.5.4 Mann-Whitney U Test on Income Level

Considering data collected from the Top 20% (T20) did not meet the criteria of 30 samples, the Central Limit Theorem (CLT) was not valid for significant statistics. Accordingly, this study primarily examines the significant differences between the income group of the Bottom 40% (M40) and the Middle 40% (M40).

Following are two hypotheses generated:

Null hypothesis (H_0): There is no significant difference between B40 (RM 4,849 and below) and M40 (RM 4,850 to RM 10,959) homebuyers in the post-COVID-19 housing preferences.

Alternative hypothesis (H_1): There is a significant difference between B40 (RM 4,849 and below) and M40 (RM 4,850 to RM 10,959) homebuyers in the post-COVID-19 housing preferences.

Table 4.14: Mann-Whitney U Test on Income Level.

Code	Post-Covid-19 Housing Preferences	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
B1	Community Type	1441	4927	-2.227	0.026

The result of the Mann-Whitney U test on income level is provided in Table 4.14. There is one post-COVID-19 housing preference, **B1** = "Community Type", with a p-value less than 0.05. It implies a significantly different perception of housing preference between B40 and M40 income groups. Shortly, the null hypothesis (H_0) is rejected for this housing preference.

Table 4.15: Mean Rank of Post-COVID-19 Housing Preferences across Income Level.

Code	Post-Covid-19 Housing Preferences	Income Level	N	Mean Rank	Sum of Ranks
B1	Community Type	RM 4,849 and below (B40)	83	59.36	4927.00
		RM 4,850 to RM 10,959 (M40)	**45**	**73.98**	**3329.00**

Note: **Bold** indicates the highest mean rank

A comparison of the mean rank of M40 and B40 populations on post-COVID-19 housing preference is shown in Table 4.15. It appears that homebuyers of different income levels have significant differences in merely community type. It contrasts with Mang, Zainal and Radzuan (2018) who showed no effect of income levels on location parameters in Malaysia. The result could be explained by Bujang, Zarin and Jumadi (2010) that a high earner with higher affordability is more likely to purchase a better house than a low earner with limited finances. In the case of moving out of the city centre to avoid contracting the disease (Muhyi and Adianto, 2021), there is no doubt that M40 values community type more than B40 since they have the financial capability to select whether to live in an urban, suburban, or rural area that matches their ideal living environment, but B40 might look for the most affordable option, regardless of its location.

4.6 Kruskal-Wallis Test

Kruskal-Wallis Test is conducted to discover the significant differences in post-COVID-19 housing preferences across different age groups, ethnicity, and educational levels of homebuyers. A critical chi-square value is defined as 5.991 with an adopted p-value of 0.05 and a degree of freedom of 2 when three respondent groups are to be tested.

4.6.1 Kruskal-Wallis Test on Ethnicity

Two hypotheses are presented as follows:

Null hypothesis (H_0): There is no significant difference across the ethnicity of homebuyers in the post-COVID-19 housing preferences.

Alternative hypothesis (H_1): There is a significant difference across the ethnicity of homebuyers in the post-COVID-19 housing preferences.

Table 4.16: Kruskal-Wallis Test on Ethnicity.

Code	Post-COVID-19 Housing Preferences	Kruskal-Wallis H	Asymp. Sig.
B3	Neighbourhood Quality	6.590	0.037
B4	Accessibility to Restaurant and Groceries Market	6.116	0.047
B6	Accessibility to Recreational Facilities	9.974	0.007
D8	Workout Area	7.433	0.024
E2	Air-conditional System	7.208	0.027
E6	Energy-efficient Features	8.863	0.012
F6	Spaciousness	9.765	0.008

Table 4.16 summarises the results of the Kruskal-Wallis test on ethnicity. It presents seven post-COVID-19 housing preferences with an h-value larger than 5.991 and a p-value less than 0.05. These housing preferences are **B3** = "Neighbourhood Quality", **B4** = "Accessibility to Restaurant and Groceries Market", **B6** = "Accessibility to Recreational Facilities", **D8** = "Workout Area", **E2** = "Air-conditional System", **E6** = "Energy-efficient Features" and **F6** = "Spaciousness". The result interprets significant differences among Chinese, Malay and Indians in perceiving housing preferences. Thus, it rejects the null hypothesis (H_0) for these seven housing preferences.

Table 4.17: Mean Rank of Post-COVID-19 Housing Preferences across Ethnicity.

Code	Post-COVID-19 Housing Preferences	Ethnicity	N	Mean Rank
B3	Neighbourhood Quality	*Chinese*	*74*	*65.28*
		Malay	33	68.97
		Indian	**34**	**85.41**
B4	Accessibility to Restaurant and Groceries Market	*Chinese*	*74*	*65.99*
		Malay	33	67.85
		Indian	**34**	**84.97**
B6	Accessibility to Recreational Facilities	*Chinese*	*74*	*61.47*
		Malay	33	77.39
		Indian	**34**	**85.54**
D8	Workout Area	*Chinese*	*74*	*64.57*
		Malay	33	69.35
		Indian	**34**	**86.59**
E2	Air-conditional System	Chinese	74	68.03
		Malay	*33*	*62.21*
		Indian	**34**	**86.00**
E6	Energy-efficient Features	Chinese	74	70.61
		Malay	*33*	*57.18*
		Indian	**34**	**85.25**
F6	Spaciousness	Chinese	74	67.11
		Malay	*33*	*61.74*
		Indian	**34**	**88.44**

Note: **Bold** indicates the highest mean rank
Italic indicates the lowest mean rank

As shown in Table 4.17, Indians rank higher importance level in post-COVID-19 housing preferences than other ethnicities. There are significant differences in mainly locational parameter (B) and structural and equipment parameter (E) across ethnic groups. This study supported Sinniah, et al. (2014) who discovered ethnic groups differ in choosing housing locations based on their culture, perspective, and religion. Besides, the results are also in tandem with Majid, Said and Daud (2012) whereby there is a distinct difference in the choice of community neighbourhood quality across ethnicities.

Apparently, Indians prioritise neighbourhood quality, and accessibility to restaurants, grocery stores, and recreation facilities over Malays and Chinese. The reason behind this is that ethnicities prefer to live in communities comprised of their own race (Havekes, Bader and Krysan, 2016). Despite being the third largest ethnic group in Malaysia, Indians only make up 6.6% of the population (Department of

Statistics Malaysia Official Portal, 2022). Hence, Indians are more likely to gravitate toward places with a Hindu community sharing similar traditions, recreational activities, and food, as opposed to Chinese and Malays, whose cultures can be easily found in any region.

In Feng Shui, spatial management to create a workout area, installation of mechanical and ventilation schemes and design of interior layout and shape of the room that contributes to a sense of spaciousness are parts of the internal layout modules (Shafii, Yi and Yassin, 2020). Yap and Lum (2020) found that the Chinese homebuyers give the most value to the internal layout and interior arrangement of a building before the pandemic, followed by Indians, then Malays. However, this study disclosed that Indians value internal layout more than other ethnic groups after the pandemic. It might be due to the poor living conditions that caused negative effects on Malaysians during the pandemic. As a result, Feng Shui, which is believed that could promote health and happiness, is increasingly in demand among Indians, but show a minor effect on Malays.

4.6.2 Kruskal-Wallis Test on Age

The age group of "41 years old to 50 years old" and "51 years old and above" were combined to conduct significant statistics using Central Limit Theorem (CLT). Accordingly, three age groups are to be analysed, which are "21 years old to 30 years old", "31 years old to 40 years old", and "41 years old and above".

The two formulated hypotheses are as stated:

Null hypothesis (H_0): There is no significant difference across the age group of homebuyers in the post-COVID-19 housing preferences.

Alternative hypothesis (H_1): There is a significant difference across the age group of homebuyers in the post-COVID-19 housing preferences.

Table 4.18: Kruskal-Wallis Test on Age.

Code	Post-COVID-19 Housing Preferences	Kruskal-Wallis H	Asymp. Sig.
A2	Interest Rate	13.088	0.001
B2	Community Density	17.206	0.000
B3	Neighbourhood Quality	9.429	0.009

Table 4.18 (Cont'd)

Code	Post-COVID-19 Housing Preferences	Kruskal-Wallis H	Asymp. Sig.
C1	Housing Type	16.944	0.000
C2	Housing Size and Space	11.007	0.004
C5	Number of Rooms	6.104	0.047
F1	Indoor Air Quality (IAQ)	6.408	0.041
F2	Thermal Comfort	9.317	0.009
F5	View Quality	10.529	0.005

Table 4.18 denotes the results obtained from Kruskal-Wallis Test on age group. There are nine post-COVID-19 housing preferences with an h-value larger than 5.991 and a p-value less than 0.05. The nine housing preferences are **A2** = "Interest Rate", **B2** = "Community Density", **B3** = "Neighbourhood Quality", **C1** = "Housing Type", **C2** = "Housing Size and Space", **C5** = "Number of Rooms", **F1** = "Indoor Air Quality (IAQ)", **F2** = "Thermal Comfort", and **F5** = "View Quality". It observed significant differences among age groups of 21 to 30 years old, 31 to 40 years old and 41 years old and above regarding the perception of housing preferences. Hence, null hypothesis (H_0) for these nine housing preferences.

Table 4.19: Mean Rank of Post-COVID-19 Housing Preferences across Age Groups.

Code	Post-COVID-19 Housing Preferences	Age	N	Mean Rank
A2	Interest Rate	21 years old to 30 years old	73	67.45
		31 years old to 40 years old	*35*	*59.37*
		41 years old and above	**33**	**91.20**
B2	Community Density	*21 years old to 30 years old*	*73*	*62.86*
		31 years old to 40 years old	35	64.67
		41 years old and above	**33**	**95.73**
B3	Neighbourhood Quality	21 years old to 30 years old	73	67.90
		31 years old to 40 years old	*35*	*61.27*
		41 years old and above	**33**	**88.18**
C1	Housing Type	*21 years old to 30 years old*	*73*	*60.74*
		31 years old to 40 years old	35	70.26
		41 years old and above	**33**	**94.48**
C2	Housing Size and Space	*21 years old to 30 years old*	*73*	*63.75*
		31 years old to 40 years old	35	68.09
		41 years old and above	**33**	**90.12**

Table 4.19 (Cont'd)

Code	Post-COVID-19 Housing Preferences	Age	N	Mean Rank
C5	Number of Rooms	*21 years old to 30 years old*	*73*	*65.84*
		31 years old to 40 years old	35	68.17
		41 years old and above	**33**	**85.41**
F1	Indoor Air Quality (IAQ)	*21 years old to 30 years old*	*73*	*66.55*
		31 years old to 40 years old	35	66.94
		41 years old and above	**33**	**85.14**
F2	Thermal Comfort	21 years old to 30 years old	73	68.60
		31 years old to 40 years old	*35*	*60.26*
		41 years old and above	**33**	**87.70**
F5	View Quality	*21 years old to 30 years old*	*73*	*65.14*
		31 years old to 40 years old	35	65.14
		41 years old and above	**33**	**90.18**

Note: **Bold** indicates the highest mean rank
Italic indicates the lowest mean rank

Table 4.19 presents that the respondents from the age group of "41 years old and above" have a higher mean ranking in the post-COVID-19 housing preferences. Similarly, Majid, Said and Daud (2012) highlighted that there are significant differences between different age groups in housing preferences. However, it is surprising that homebuyers above 40 years old have a highest financial concern than those below 41 years old. It contrasts with the findings of Bujang, et al. (2015), Khan, et al. (2017), Zamri, Yaacob and Suki (2021). Their studies showed that the younger generation with low financial stability placed more emphasis on financial attributes than the older generation. This result might be due to the interest rate plays a significant role for homebuyers over the age of 40 in evaluating the financial costs and profit gains associated with purchasing a home for investment purposes.

Apart from that, the obtained results denoted that the elderly more than 40 years old emphasises housing preferences on every parameter than 20 to 40 years old homebuyers after the pandemic, including the locational parameter (B), physical parameter (C), and health and comfort parameter (F). This is because these parameters are relevant to the living quality during retirement life. This is in line with the finding of Ismail, et al. (2020) that older generations value housing quality along with neighbourhood conditions more than younger generations, particularly living environmental and physical housing attributes are considered health-related factors after the pandemic. Comparatively, 21- to 30-year-olds and 31- to 40-year-olds tend

to have similar ranking in post-pandemic housing preferences owing to their similar circumstances in the life cycle, such as studies and career advancements.

4.6.3 Kruskal-Wallis Test on Educational Level

To allow significant analysis based on the Central Limit Theorem (CLT), the education level of "High School", "Foundation / A-Level / STPM / UEC", and "Diploma" were grouped as "Lower-educated"; "Bachelor's Degree" was classified as "Educated"; "Master's Degree" and "Doctorate" were categorised as "Upper-educated". Hence, the significant differences between three grouping of educational levels are investigated, namely "Lower-educated", "Educated", and "Upper-educated".

The two hypotheses are as below:

Null hypothesis (H_0): There is no significant difference across the educational level of homebuyers in the post-COVID-19 housing preferences.

Alternative hypothesis (H_1): There is a significant difference across the educational level of homebuyers in the post-COVID-19 housing preferences.

Table 4.20: Kruskal-Wallis Test on Educational Level.

Code	Post-COVID-19 Housing Preferences	Kruskal-Wallis H	Asymp. Sig.
A3	Loan Service	11.992	0.002
B4	Accessibility to Restaurant and Groceries Market	8.364	0.015
B7	Accessibility to Workplace	6.351	0.042
B9	Accessibility to Fibre-optic Broadband Services	6.951	0.031
B10	Accessibility to Home Delivery	7.091	0.029
C4	Spatial Design for Privacy	11.745	0.003
D7	Home Office	12.356	0.002
H1	Internet Connectivity	7.130	0.028

Table 4.20 exhibits the results of the Mann-Whitney U test on educational level. Eight post-COVID-19 housing preferences with an h-value larger than 5.991 and a p-value less than 0.05. The housing preferences are **A3** = "Loan Service", **B4** = "Accessibility to Restaurant and Groceries Market", **B7** = "Accessibility to Workplace", **B9** = "Accessibility to Fibre-optic Broadband Services", **B10** = "Accessibility to Home Delivery", **C4** = "Spatial Design for Privacy", **D7** = "Home

Office", **H1** = "Internet Connectivity". It discovered significant differences among lower-educated, educated, and upper-educated homebuyers in housing preferences. Accordingly, the null hypothesis (H_0) is rejected for these eight housing preferences.

Table 4.21: Mean Rank of Post-COVID-19 Housing Preferences across Educational Level.

Code	Post-COVID-19 Housing Preferences	Educational Level	N	Mean Rank
A3	Loan Service	Lower-educated	42	73.57
		Educated	**66**	**79.18**
		Upper-educated	*33*	*51.36*
B4	Accessibility to Restaurant and Groceries Market	Lower-educated	42	66.96
		Educated	**66**	**80.20**
		Upper-educated	*33*	*57.74*
B7	Accessibility to Workplace	*Lower-educated*	*42*	*61.82*
		Educated	**66**	**79.34**
		Upper-educated	33	66.00
B9	Accessibility to Fibre-optic Broadband Services	*Lower-educated*	*42*	*58.24*
		Educated	**66**	**77.68**
		Upper-educated	33	73.88
B10	Accessibility to Home Delivery	*Lower-educated*	*42*	*58.39*
		Educated	**66**	**78.99**
		Upper-educated	33	71.06
C4	Spatial Design for Privacy	*Lower-educated*	*42*	*56.75*
		Educated	**66**	**82.03**
		Upper-educated	33	67.08
D7	Home Office	*Lower-educated*	*42*	*54.11*
		Educated	**66**	**81.27**
		Upper-educated	33	71.95
H1	Internet Connectivity	*Lower-educated*	*42*	*58.32*
		Educated	66	75.88
		Upper-educated	**33**	**77.38**

Note: **Bold** indicates the highest mean rank
Italic indicates the lowest mean rank

Table 4.21 displays that post-COVID-19 housing preferences of educated Malaysian homebuyers outrank those of lower-educated and upper-educated. It differs from Haddad, Judeh and Haddad (2011) and Hei and Dastane (2017) who reported that educational level is not a significant determinant of housing purchase decisions. The first concern for lower- and medium-educated homebuyers is loan services affecting their ability in home purchasing. There is a rationale that lower-

and medium-educated categories put more weightage on loan services post-pandemic since their earning potential is lower than upper-educated homebuyers (Abdullah, et al., 2012).

This study found significant differences in the location parameter across educational levels. The educated homebuyers prioritise both home delivery and restaurant and groceries market access among educational levels because of posing diverse post-pandemic lifestyles, as explained by Hurtubia, Gallay and Bierlaire (2010). Moreover, similar results to Mang, Zainal and Radzuan (2018) exhibited that medium- and upper-educated homebuyers value the accessibility to workplaces more than the less educated. It might be due to educated jobs and companies being highly concentrated in cities which makes higher-educated homebuyers travelling to work difficult, whereas job opportunities for lower-educated homebuyers are less location dependent.

On the other hand, higher education backgrounds encourage homebuyers to purchase more expensive homes with better living quality (Majid, Said and Daud, 2012). Hence, it is consistent with the result which disclosed that internet connectivity is of utmost importance to upper-educated homebuyers following the pandemic to ensure living satisfaction. Besides, medium- and upper-educated homebuyers are primarily engaged in remote working and studying during the pandemic. Due to this, they place a higher priority on fibre-optic broadband access, spatial design for privacy and having a specific office at home, as compared to less educated homebuyers with physical labour work.

4.7 Chapter Summary

This chapter provides a comprehensive discussion of the post-COVID-19 housing preferences that will influence the purchasing decisions of homebuyers in the wake of the pandemic. In total, 145 questionnaires were returned, but 4 sets were discarded for not being relevant to the research scope. Following, collected data were analyzed using Cronbach's Alpha Reliability Test, Friedman Test, Mann-Whitney U Test, and Kruskal-Wallis Test. Based on the Friedman test, it was revealed that the health and comfort parameter (F) were highly appreciated by homebuyers, whereas the green parameter (G) was least valued. Furthermore, the Mann-Whitney U Test indicated a significant difference between gender, marital status, household size, and income

level in post-COVID-19 housing preferences. Kruskal-Wallis Test also found significant differences between ethnicities, ages, and educational levels.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter concludes the overall study. It begins with the accomplishment of the research objective and the outcome of the findings. Then, the contributions of the study are highlighted. Lastly, the limitations encountered during the study are acknowledged and the recommendations for future research are proposed.

5.2 The Accomplishment of Research Objectives

The accomplishments of the research objectives are summarised in the following sections.

5.2.1 Objective 1: To identify post-COVID-19 housing preferences in Malaysia

The first objective was achieved through a literature review. A total of fifty-one post-COVID-19 housing preferences have been identified to influence homebuyers' purchasing decisions following the pandemic, as illustrated in Figure 2.1. The fifty-one housing preferences were categorised into eight parameters, which are financial, locational, physical, structural, equipment, spatial arrangement, health and comfort, green, and technological.

5.2.2 Objective 2: To evaluate the importance level of post-COVID-19 housing preferences in Malaysia

The second objective was fulfilled by collecting the perspective of respondents on the importance level of housing preferences through a questionnaire and performing the Friedman test to rank the importance levels. A higher mean ranking of housing preferences indicates that the preferences are prioritised by homebuyers after the pandemic. The study revealed that among the eight main parameters, the "health and comfort parameter" (F) is the most important consideration for homebuyers post-pandemic, followed by the "financial parameter" (A), while the "green parameter" (G) is the least relevant. Besides, **F4** = "Acoustic Quality", **H1** = "Internet

Connectivity", and **F1** = "Indoor Air Quality (IAQ)" are the top three housing preferences significant to homebuyers following the pandemic.

5.2.3 Objective 3: To investigate the influence of social demographics on post-COVID-19 housing preferences in Malaysia

The third objective was accomplished through the Mann-Whitney U Test and Kruskal-Wallis Test to examine the differences in housing preferences among homebuyers from diverse demographic backgrounds. The investigated social demographics included gender, age, ethnicity, marital status, household size, educational level and income level. Based on the finding, there were significant differences in housing preferences across all social demographics.

First, females prefer **B10** = "Accessibility to Home Delivery" and **D1** = "Additional or Separated Bathroom" than males. Next, single homebuyers emphasise **B10** = "Accessibility to Home Delivery", while married homebuyers emphasise **C1** = "Housing Type". Then, households with children concern **A2** = "Interest Rate", **B2** = "Community Density", **B3** = "Neighbourhood Quality" and **C1** = "Housing Type" than households without children. Moreover, larger households value **C5** = "Number of Rooms", **D2** = "Separated Kitchen", **D8** = "Workout Area", **D9** = "Recreational Area (Balcony, Terrace, Outhouse, Garden)", whereas smaller households value **E1** = "Natural Ventilation System". Further, **B1** = "Community Type" is more considered by higher earners than lower earners.

On the other hand, "locational parameter" (B), "spatial arrangement parameter" (D), "structural and equipment parameter" (E), and "health and comfort parameter" (F) are the most prioritised by Indians among the three ethnicities. Furthermore, the age group of "41 years old and above" favours "financial parameter" (A), "locational parameter" (B), "physical parameter" (C), and "health and comfort parameter" (F) than "21 years old to 30 years old" and "31 years old to 40 years old". In addition, educated homebuyers place great importance on the "financial parameter" (A), "locational parameter" (B), "physical parameter" (C) and "spatial arrangement parameter" (D) over lower- and upper-educated homebuyers. Meanwhile, upper-educated homebuyers place emphasis on "technological parameter" (H) than other educational categories.

5.2.4 Conclusion

An in-depth investigating of post-COVID-19 housing preferences is carried out through the accomplishment of three objectives. This study discovered that new housing preferences have evolved in response to the pandemic. Some home features that were less emphasised before the pandemic are now being given greater attention, especially related to health. It seems that post-pandemic housing preferences are imperative for homebuyers to adapt to a new lifestyle and ensure their quality of life. In addition, homebuyers with differing social demographic backgrounds will have different housing preferences that influence home purchasing.

5.3 Research Contributions

This study is expected to contribute to the property developers in order to have a better understanding of the housing preferences following the pandemic. The findings are beneficial in gaining competitive advantages and reducing the possibility of oversupply housing products that do not match the new norms. By referring to the results of housing preferences, the developers could incorporate new trends in property development to meet homebuyers' latest demands and expectations. Besides, marketing strategies could be established to reach targeted homebuyers based on different social demographics by tailoring the housing product that better suits a specific group's needs and preferences. Meanwhile, property investors and buyers could be benefitted from the housing product that caters to their needs and have greater living satisfaction.

Furthermore, this study contributes to local government related to the housing industry, such as the Minister of Housing and Local Government, on housing development and formulation of housing policies integrating the consideration of the COVID-19 impacts. For instance, governments could provide incentives and subsidies for home purchasing or develop affordable housing as homebuyers pay greater attention to financial attributes. In addition, strengthening policies or housing regulations on health and comfort aspects could help improve the housing quality and occupants' living experience, which are the top concerns of homebuyers after the pandemic.

On top of that, this study contributes to the body of knowledge by expanding the existing knowledge of housing preferences in Malaysia. The findings close the

knowledge gap identified by the lack of research about housing preferences in the aftermath of the pandemic. Besides, the study could serve as a reference for future relevant studies.

5.4 Research Limitations

Despite the research contributions, this study has several limitations. First, this study adopted a single data collection method instead of a mixed approach. The administration of the quantitative survey approach restricts the provision of in-depth and comprehensive justification from the respondents. Besides, the closed-ended questions constrain the extent of exploration beyond the provided options. Second, the subjective nature of the Likert scale survey might lead to less precise and reliable results than the non-Likert scale method since respondents would interpret rating scales differently.

Third, the sampling frame of this study is limited to the respondents in Klang Valley, which might make it less reliable to generalise to Malaysia as Malaysians from other states might have different perceptions regarding post-COVID-19 housing preferences. Additionally, Sabahan and Sarawak minorities are excluded to be studied. Fourth, the data obtained from the sample was imbalanced to demonstrate the disparity between the demographics of respondents. The inadequacy of respondents of some demographic groups, such as age groups and educational levels, might affect the accuracy of the Kruskal-Wallis test results.

Fifth, there is limited information available within the domestic housing industry concerning housing preferences in the context of the COVID-19 pandemic. In this study, the majority of the post-COVID-19 housing preferences were obtained from foreign countries, which might lead to undetected post-pandemic housing preferences in Malaysia.

5.5 Research Recommendations

Some recommendations are proposed for future research to overcome the aforementioned limitations. First, a mixed approach is suggested for data collection to optimise the advantages of qualitative and quantitative methods so that numerical data and in-depth descriptive results can be obtained simultaneously to enhance the reliability and richness of findings. Second, an alternative to Likert-type scales could be adopted to reflect the actual responses, such as the Slider scale or Semantic

differential scale. Third, it is recommended to extend the scope of research geographically to other states in Malaysia and increase the sample size to ensure more generalisable findings for representing the whole Malaysian population. Fourth, to guarantee the accuracy and reliability of statistical analysis results, a balanced sample size for each demographic group is vital to future research by closely monitoring the survey response rate.

For future research, a similar study could be conducted in other states of Malaysia to observe whether there are significant differences in the perception of housing preferences among homebuyers from each region. Moreover, it would be interesting to extend this study by providing further and deeper insight into the reason specific social backgrounds have a preference for certain housing attributes, such as analysing the underlying causes of gender differences in housing preferences and explaining how gender roles and behaviour affect the preferences.

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APPENDICES

APPENDIX A: Questionnaire

Section A: Respondent's Information

1. Select your gender.
   - Male
   - Female

2. Select your ethnicity.
   - Malay
   - Chinese
   - Indian
   - Others: _____

3. Select your age group.
   - Below 21 years old
   - 21 years old to 30 years old
   - 31 years old to 40 years old
   - 41 years old to 50 years old
   - 51 years old and above

4. Select your current marital status.
   - Single (Proceed to Q6)
   - Married (Proceed to Q5)
   - Divorced (Proceed to Q5)
   - Widowed (Proceed to Q5)

5. How many children do you have? (Prior to Q4)
   - _____

6. Are you living with family members?
   - Yes (Proceed to Q7)
   - No (Proceed to Q8)

7. How many family members live together with you? (Prior to Q6)
   - _____

8. How many people live with you in a house? (Prior to Q6)
   - _____

9. Select your highest education level.

- High school
- Foundation / A-Level / STPM / UEC
- Diploma
- Bachelor's Degree
- Master's Degree
- Doctorate
- Others: _____

10. Select your current monthly income.
    - RM 4,849 and below
    - RM 4,850 to RM 10,959
    - RM 10,960 and above

Section B: Post-COVID-19 Housing Preferences

COVID-19 pandemic had resulted in stay-at-home and lockdown, which changed the way people live. Poor housing quality can lead to health issues, inconveniences, and transmission of Coronavirus. Therefore, the following section lists the housing preferences that may be demanded after the pandemic. According to your perception and experience, rate each housing preference's importance after the COVID-19 pandemic.

The Importance Levels of Post-COVID-19 Housing Preferences	Not Important	Less Important	Moderately Important	Very Important	Extremely Important
	1	2	3	4	5
Financial Parameter					
The housing price					
The interest rate offered by the banks					
The housing loans offered by the banks (E.g., easy access to housing loans)					
The government subsidies (E.g., stamp duty exemption and income tax relief to ease the burden of homebuyers)					
The bank or financial institution support provided to eligible borrowers in housing purchases (E.g., guarantee scheme, flexible loan repayment, etc.)					
Locational Parameter					
The location of the house (E.g., housing					

located in urban – Kuala Lumpur city centre or suburban – Ampang, Cheras, Kepong, Setapak or rural areas – Bangi, Semenyih)					
Neighbourhood density (E.g., low density, less crowded community)					
The quality of the neighbourhood in terms of security or quietness, or closeness to nature					
Accessibility to restaurants and groceries market					
Accessibility to healthcare facilities (E.g., hospital, clinic, pharmacy)					
Accessibility to recreational facilities (E.g., parks, playgrounds, sports centres, etc.)					
Accessibility to the workplace					
Accessibility to public transport					
The availability of fibre-optic broadband services in the neighbourhood (E.g., connectivity to Internet providers such as TM Net, Maxis, Astro IPTV, etc.)					
The availability of delivery services to the neighbourhood (E.g., food delivery such as Grab and Food Panda, online shopping delivery such as Shopee, Lazada and Go Shop)					
Physical Parameter					
The housing type (E.g., landed buildings, low-rise and high-rise buildings)					
The housing size (E.g., build-up area)					
The adaptability and flexibility of housing layout and space (E.g., living space can be changed and modified to suit the new need that arises)					
The privacy of home activities (E.g., spatial separation, having personal spaces)					

The number of rooms					
Space Arrangement Parameter					
Having additional or separate bathrooms to support self-isolation					
Having separated kitchen to avoid sharing enclosed spaces					
Having entrance with cleaning and washing area to have immediate self-cleaning after returning home					
Having a drop-off zone to accommodate increasingly home parcels and online deliveries					
Having an airing area to remove the packaging of commodities before bringing them into the house					
Having extra storage spaces to accommodate increasingly household appliances					
Having a home office to accommodate Work from Home (WFH)					
Having an indoor workout area to exercise and do physical activity at home					
Having an indoor recreational area for leisure and relaxation (E.g., balcony, terrace, outhouse, garden, etc.)					
Structural and Equipment Parameter					
Use of natural ventilation system (E.g., purpose-built openings, such as windows and doors)					
Use of the air-conditional system					
Use of the natural lighting system (E.g., exterior glazings, such as windows and skylights)					
Use of sound insulation features (E.g., sound-absorbing materials within the wall layer)					
Use of safe building materials (E.g., low					

Volatile Organic Compounds (VOC) paints, eco-products, etc.)					
Use of energy-efficient features (E.g., installing LED light, motion sensor, solar panel, etc.)					
Health and Comfort Parameter					
The air circulation to ensure the indoor air quality (E.g., sufficient fresh air, regular air exchange)					
The indoor temperature to ensure the thermal comfort (E.g., an appropriate temperature that is not too hot or too cold)					
The lighting level to ensure lighting comfort (E.g., adequate lighting to light up area, appropriate lighting to the functional requirements of each area					
The absence of noise and sound disturbance at home					
The presence of an outdoor view through the windows					
The sense of spaciousness and openness in the house					
Green Parameter					
Having green spaces in the housing area (E.g., front or back yard, outdoor play area, balcony with plant boxes)					
The presence of green views around the house (E.g., the scenery of grassland, mountains, pond, etc.)					
The installation of green infrastructure (E.g., green walls, green roofs) to maximize energy efficiency and improve indoor comfort					
Having a gardening area for mental health and hobby (E.g., yard, balcony or garden to plant vegetation)					
Technological Parameter					

Internet connectivity to support expanding internet-based activities					
Fifth-generation wireless (5G) for fast internet speed and responsiveness					
Home automation promotes contactless and touchless functionalities (E.g., motion detection, controlled lighting and ventilation, smart-cleaning toilets, etc.)					
Smart indoor management to maximize energy-efficient and indoor comfort (E.g., temperature and humidity control, lighting management, etc.)					
Smart wellness system for home healthcare (E.g., wireless sensors on blood pressure, temperature and pulse, symptoms detection, etc.)					
Security system to safeguard the household (E.g., CCTV, anti-theft system, security alarm, etc.)					