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2022

“Sustaining the
Resilient, Beautiful and Safe Cities
for a Better Quality of Life”

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A SYSTEMATIC LITERATURE REVIEW ON ROAD INFRASTRUCTURE INDICATORS BASED ON DISTANCE AND THE EFFECT ON AFFORDABILITY OF HOUSING

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Abstract

This systematic review article focuses on the road infrastructure indicators based on distance, and explores into its ability to affect house prices within the context of the Malaysian property market. Most of the past researches conducted on this topic were mostly from the engineering perspective, not from Asian region and seldomly being conducted on the basis of built environment perspective. This provides a basis for the researchers in deciding ultimately on how this can affect the public's ability in purchasing affordable houses. The researchers intend to outline the road infrastructure indicators based on distance and affordability of housing as this paper's aim. The objective of this paper is to provide the indicators as basis for further measurement on prices of affordable housing. The methodology for this review paper is via the implementation of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), and two main journal databases were utilised that were Web of Science and Scopus. From the considerable number of past researches obtained and the systematic review conducted, the researchers has extracted seven main themes, namely traffic number, cost of commute, vehicle mobility, travel time, workplace distance, road network distance and houses desirability. Based on the findings of the main themes, several recommendations for further research were then highlighted at the end of the review paper which include utilizations by various stakeholders in determining affordable housing, with the improvement relating to road infrastructure indicators in the context of Malaysia. The themes were then expected to become the basis for future data collection process by the researchers.

Keywords: Affordable Housing, Distance, Road Infrastructure, Systematic Literature Review

INTRODUCTION

The previous Covid-19 pandemic that have affected the world during the year 2020 until 2021, have seen a large decrease of workers commuting from their respective houses to their workplaces. This situation has attributed to the decrease in traffic number on the roads, as most workers were adopting the Work from Home policy, in order to reduce the chance of

contracting the disease. Now, as the world is recovering from the pandemic and entering the endemic phase, workers are now instructed to report back to offices and be present physically, thus contributing to higher amount of traffic on the roads. Recent media reporting, especially in Malaysia, have shown that traffic number in the Klang Valley have risen, and thus contributing towards the traffic jams in and out of the city centre (Zulkifli, 2022). The waiting time in traffic have grown exponentially from a typical 2 minutes per kilometres in the Klang Valley to around 5 minutes per kilometres. This has led to workers choosing to commute from their houses to their respective workplaces in the shortest time possible. For the purpose of this research, the researchers intend to outline the road infrastructure indicators based on distance and affordability of housing as this paper's aim. The objective of this paper is to provide the indicators as basis for further measurement on prices of affordable housing. These factors were important as residential houses with prices considered affordable were seen to be built further away from the city centre, with higher distance of commuting affecting them (Chan & Adabre, 2019). This paper employs the Systematic Literature Review, and aims to look at the road infrastructure indicators based on distance and its effect on affordable housing, emphasizing on the price of houses being offered in Malaysia. The findings gathered will then be adopted for the basis of indicators in the next stage of data collection on chosen case studies in Malaysia. The implementation of SLR, not only gives wide areas of research scope, it also helps in determining the most suitable indicators to be implemented, and reviewed so that several themes can be focused afterwards.

LITERATURE REVIEW

This paper was written with the aim of obtaining as many indicators for road infrastructure, and how it affects the affordable housing provision and purchasing ability of people in Malaysia. These indicators based on previous research then were reviewed, and analysed so that suitable and unsuitable indicators can either be included and excluded. For this SLR paper, the PRISMA system was adopted from Moher et al., (2010), and the description for the system was further elaborated and adopted by Mohamed Shaffril et al., (2019). The PRISMA system, which was primarily designed for usage in medical studies, was peer reviewed by an extensive number of researchers, and proven to be suitable to be implemented in various fields, including the transportation and built environment field which the researcher is focusing on. This were supported by other researchers such as Neilson et al., (2019) and Amiour et al., (2022) which adopted the SLR method in their respective researches.

To get the overall comprehension relating to this research topic, the researchers need to review two main aspects of the research, which are the road infrastructure indicators based on distance, and affordability of housing. The first aspect which relates to road infrastructure, means the actual physical infrastructure that were available on roads being built on physical lands, and this can include whether public, private or even highway systems. Tokunova, (2018) further cemented this idea by stating that investment conducted on road systems with various indicators are a catalyst for connectivity to places of work, leisure, education and also residential. The researchers agree with this statement as without roads, mobility of humankind in the twenty first century will be severely limited as people are relying more and more on modern transportation to move from one point to another. In this aspect, the researchers focuses more towards the automobile or cars, as this is the main transportation being employed especially in a developing country like Malaysia. Roosli et al., (2019) in their research also supported this idea as transportation in the country is still being dominated by automobile, as compared to other forms of transportation like Bus Rapid Transit, Light Rapid Transit, Monorail, and cycling. As this situation looks uncertain to change in the near future, the researchers have reviewed and decided to focus on the concept of automobile to be adopted as the only transportation mode for the purpose of this research.

The next important aspect of this research is the incorporation of the affordable housing provision in Malaysia. The concept of affordable housing differs according to various states in the country, but how do we determine whether a house is truly affordable? Surely this has to be measured through the income level of the population, and the federal government has already characterised household in the country based on income level of B40, M40, and T20 respectively. The explanation for this is Below 40%, Middle 40% and the Top 20%. These classifications also differ from state to state, and not necessarily portray the same level of income such as comparing the federal territory of Kuala Lumpur and the state of Perak. The classification changes based on the actual location a person lives, and how much income they received in that particular state. Daud et al., (2022) also highlighted that affordable housing in Malaysia within that price range were affected by policy, urban design and planning, demand and supply, overhang of properties, financing availability and also the prices itself. This shows that factors of impeding affordable housing were abundant, and ultimately affects the population itself. Previous research such as Masri et al., (2017) also showed that locational aspect of the houses will affect the house prices, thus contributing to the population in finding the best value for money houses, that may be located further away from city centres and their workplaces. From the above statements, the novelty for this research to be conducted is to produce the road infrastructure indicators needed to measure their relationship with affordable house prices. This was shown in the initial review of past researchers that shows significance research gap to be filled through the implementation of this study.

In summary of the literature review, there are several contributing factors that affects affordable housing prices, such as their location, and their road infrastructure linking the houses to the population's workplaces. This research therefore was carried out with the hypothetical theory of the further away houses located, the more affordable the prices will be. This research also highlights the importance of having the road infrastructure indicators mapped out, in order to determine their effect on affordable housing in the next research conducted.

METHODOLOGY

As highlighted earlier, the methodology employed for this SLR is the adopted PRISMA or Preferred Reporting Items for Systematic Reviews and Meta-Analyses as developed by Moher et al., (2010). The adoption of this system helps to simplify the work of the researchers, and shows the important information that will be needed to be reviewed and assembled quickly in order to determine the indicators that will be used for primary data collection stage conducted afterwards.

For the review process, the researchers have identified two main databases, which were Scopus and Web of Science. Both databases provides comprehensive journal collection that were peer reviewed and consists of high quality publications from academics all over the world. Mohamed Shaffril et al., (2019) in their research already noted that 256 study areas were available from both databases, and this were confirmed by the researchers through the availability of transportation studies as well as built environment studies inside the databases. Other databases were also considered such as ScienceDirect, ProQuest and IEEE Explore, but due to the time limitation faced by the researchers, Scopus and Web of Science were selected due to their robustness in information searching, and keyword searching ability for the results parameter. Both of these database's access were provided by the affiliated university of the majority of researchers in this study which was Universiti Teknologi MARA.

After both of the databases were selected by the researchers, now comes the aspect of identifying the prospective journals that will be incorporated in the SLR for this research topic. The search string that was being used were outlined in the table 1 below for further reference.

Table 1*Search String for the research topic*

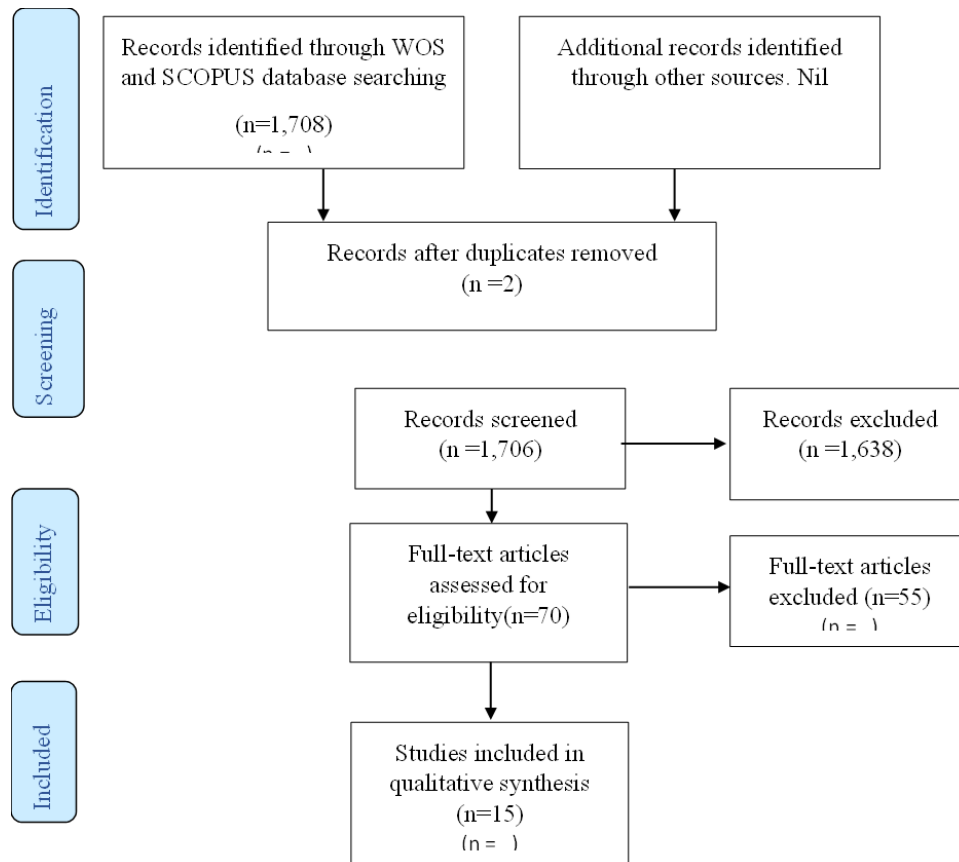
Database	Keyword 1	Keyword 2
WOS	1. Road Infrastructure	1. House
SCOPUS	1. Road Infrastructure 2. Road Indicators	1. House 2. Affordability

Based on this identification stage, the result showed around 1,294 articles based on WOS database, and 414 articles from the SCOPUS database. Both of these databased provided the articles containing dictionaries, proceeding paper, journal papers, past researchers, book chapters and thesaurus definitions. The high number of articles obtained based on the keyword that were inputted into the topic searching section by both databases results in high number of these articles, and the next stage of screening needed to be conducted in order to obtain the most relevant research materials for this research topic.

Articles from both databases now amounted to 1,708 articles, and thus needed to be screened properly in this next stage of the methodology. For the first criteria of inclusion for the research, the researcher only focuses on journal papers as this is the most comprehensive literature containing empirical data and results being analysed with adequate findings. The journals chosen were all in English, and emphasis were given to articles from the year 2022 until 2007, providing a window of 15 years for the journal articles to be included in the research. The articles being chosen were also based on transportation studies, engineering studies, and the built environment studies. Other fields obtained that were not relevant to these three main areas of studies were then subsequently omitted. Based on this screening criteria, a number of 1,638 articles were omitted, and a total number of 70 articles remained for the next stage of screening.

In the third stage of screening, the remaining 70 articles were then reviewed through the skimming technique by the researcher, with the emphasis on looking on the keywords of road infrastructure indicators, distance, affordability and house prices. Based on this, a total number of 55 articles were omitted as they did not contain any empirical data analysis based on the four prescribed keywords earlier. In this final stage of eligibility, a total number of 15 articles were deemed eligible based on the criteria set out by the researcher and ready to be analysed thoroughly and rigorously. The selection process was outlined in the figure 1 below.

Figure 1
Diagram Flow of the Research



(adapted from Moher et al., 2010)

FINDINGS AND DISCUSSION

Based on the obtained literatures that were screened using the methodology outlined above, the researchers have concluded that there were seven main themes to be incorporated in the Systematic Literature review, namely relating to traffic number, cost of commute, vehicle mobility, travel time, workplace distance, road network distance and the actual houses desirability. This has led to several findings based on the literature, and the researchers intends to discuss them according to the broken-down themes inside this research paper. The total number of papers incorporated based on the methodology consists of fifteen papers, and deemed necessary to be discussed in order to derive the recommended indicators to be used in further researches.

Theme 1 - Traffic Number

This first theme is a regular occurrence in built environment factors affecting house prices that the researcher has found out in trying to determine the suitable road infrastructure indicators and how this can affect affordable house prices. Past research conducted in Asian perspective such Zhao & Wei, (2019) showed that high traffic number affects the prices of house in China especially in the region of Taiyuan, with emphasis of business centre, medical centres and educational facilities. This research was reviewed by the researchers, and agreed upon as high traffic number results in high travelling costs, as the time period waiting in traffic will incur extra charges on the transport being used such as private vehicles. Another research conducted by Ossokina & Verweij, (2015) also showed the result that 50% reduction in traffic density will result in 1.4% house price increase. The correlation is that places that were less

congested were more desirable, thus contributing towards the higher prices of houses. Nonetheless, this theory is more suitable towards normal urban sprawling in city centres, whereas in the Malaysian context, the largest urban area is the Klang Valley based in Kuala Lumpur, Selangor and some extent towards Negri Sembilan. The researcher believes that for areas outside the region of Klang Valley, the prices of houses will be reduced because of its locational characteristic. This was supported with the research conducted by Masri et al., (2017) showing houses that were further away from city centres generally incorporate less facility and amenities as compared to houses nearer to the city centres. The discussion on this resulted in the researchers to incorporate houses within urban areas for further research, and based on previous research, the correlation between traffic number and houses prices is significant and will be incorporated further.

Theme 2 - Cost of Commute

Another worthwhile indicator found based on the review showed that cost of commute is another important factor to be followed-up. In the year 2022, the rising cost of materials, fuel, and basic necessities attributed from the end of the Covid-19 pandemic, gives burden on the livelihood of general population in the Malaysian context, and the global population generally. As major fuel producers face economic and global geo-politics difficulties, this also affects Malaysia thus contributing to higher cost of commuting using automobiles. Previous research such as Memon et al., (2021) sees this as a major reason for the public to switch to public transport, in order to alleviate traffic congestion and reducing their cost of commute. This statement is suitable to be implemented if a country's public transportation system is in good condition and user friendly, but in the Malaysian context, this may not be the case. Roosli et al., (2019) states that from the year 2000 to 2010, the urban population of Malaysia has increased from 10.2 million (43% of total population) to 15 million (53% of total population), thus showing that the country is nearing developed country status in terms of rural-urban migration theory. The higher number of people migrating to urban areas thus resulting in strained public transportation system, and without proper planning and maintenance will be more of an inconvenience rather than convenience. Reporting done by automotive journalists Lim & Tan, (2021) showed that current active vehicles in Malaysia is around 23 million, as compared to the overall population of around 33 million on the latest Malaysian census estimate. Based on simple calculation, the number of active vehicles is around 69% of the total number of populations. As with the resulting higher number of costs of commute, public transportation inconveniences, the population of Malaysia is seen as private vehicle dependent. Private vehicles give convenience, privacy, social status, but ultimately led to higher cost to the population in urban and city centres as the road infrastructures lack the ability to absorb the increased ridership. In summary for this theme, the researchers believe it will be a good indicator for the road infrastructure indicators and its effects on affordability of housing.

Theme 3 - Vehicle Mobility

In the previous theme, the cost of commute was discussed, and another theme was found that was the actual vehicle mobility. In the research conducted by Huang et al., (2018), it was shown in a small city centre of Singapore, the actual vehicle mobility of private vehicles were quite limited as the city centre focuses more towards reducing vehicle congestion. This research is suitable to be adapted in the Malaysian context, as urban city centre such as Kuala Lumpur also faces similar traffic congestion problems. A private vehicle such as an automobile can be rendered as not feasible when having to spend hours in traffic jams, as compared to smaller private vehicles such as motorcycle. Both vehicles have their advantages and disadvantages, but in terms of mobility, if traffic congestion is very high, both vehicles will be immobilized. Koryagin, (2018) states that although private vehicles have more advantages,

their convenience will be reduced drastically with their limited mobility in traffic congestion, and the eventual objective of transporting people from one point to another were not achieved. The researchers agree with this statement and also includes this indicator in the next further research.

Theme 4 - Travel Time

Previous literatures reviewed also help to produce the next theme which was the travel time of vehicles on roads. Ewing et al., (2015) has conducted in-depth research with results obtained from fifteen major cities within the United States, with the summary of shorter travel time in places with good accessibility and vice versa. In the Malaysian context, this might not be the case as places with good accessibility might result in the same congestion with the lower accessibility areas. Koryagin, (2018) gave the argument that places with higher distance from city centre will result in longer travel time as compared to housing areas nearby city centre. In term of this statement, the researchers agree with the latter as in the Klang Valley, all urban roads will eventually converge at the city centre of Kuala Lumpur. This were because Kuala Lumpur is the central financial district for Klang Valley, and recognised as the economic capital for the country of Malaysia. The higher travel time because of the higher distance to commute may be contributed by the lower house prices in the sub-urban or rural areas, but the willingness of commuters needed to be measured also in the next further research. This idea of willingness to commute were also supported by previous research such as Valibeigi et al., (2019) and (Koryagin, 2018).

Theme 5 - Workplace Distance

As travel time were associated with the distance of houses in the previous theme, therefore the researchers sees that there was significance between the actual workplace distance for these commuters. In the Malaysian context, it is considered normal for commuters to travel on the roads for more than one hour every day in their morning and evening commute. This was supported by Rahman et al., (2015) that states Malaysian commuters usually spend an excessive time travelling on roads especially during peak hours. This condition was also seen in various urban centres around the world and are considered the norm in 2022. This normalization thus eventually results in commuting accidents such were reported in Aziz & Yusof, (2015), and thus increasing the risk for commuters on a daily basis. The researchers also see that workplace distances that were too far away can have a detrimental effect on commuters as it results in higher pressure, fatigue, loss of time, loss of productivity and other increased health risk such as sitting too long in their vehicles. Thus, this indicator is an important aspect to be reviewed and brought in this research and future research.

Theme 6 - Road Network Distance

The road network distance in Malaysia encompasses a total number of 144,000 kilometres based on the latest estimate by Data, (2022) and covers both the Peninsular Region and the Borneo Region of Sabah and Sarawak. Based on this information, the Malaysian road network are considered to be extensive with both expressway and normal roads. Through the extensive road network coverage, the average Malaysians therefore have the ability to commute in their private vehicles from their houses to their workplaces. Hassan et al., (2021) showed that prices of affordable houses were determined by several factors such as location, accessibility and the overall income of the Malaysian household itself. In the research, the researchers see that in order for an average earning Malaysian to live comfortably, the distances taken from their houses to workplaces also increases exponentially. Previous research conducted by Saleh et al., (2017) also showed there are elements of housing mismatch also in terms of affordable housing and the actual location they should be located. The previous

researcher argued that a lower income Malaysian, should be provided with more affordable housing located nearby their workplaces, thus reducing the road network distance to be travelled in their daily commute, and will result in reduced cost of commute. This was shown as good in theory, but applicability needs interventionist policy by the government as the private market may not be able to provide this due to lower profit margin for their houses development. In summary, the road network distances needed to be used as indicator as highly developed city centres results in higher house prices due to locational aspect affecting them as reported also by M. H. M. Masri et al., (2021).

Theme 7 - Houses Desirability

Based on all the outlined themes, the last theme to be included is of course on the basis of the houses itself. In this sense, the desirability of houses is needed to be measured from respondents, and needed to be conducted in the further research. The concept of houses desirability correlates with the actual ability to purchase them, and in this case affordable housing is more suitable to be incorporated in the research for average median income earner in Malaysia. Researchers such as Valibeigi et al., (2019) and Osman et al., (2020) in their research already showed affordable housing differs according to country, and regions in the country such as different states due to differences in earning income of each household. Reporting from the federal government in 2022 based on offering on their affordable housing is now at the range of RM300,000 and below to be categorised as affordable housing. The issue of these affordable houses is their availability in urban city centres are limited, and the prices offered in urban fringes also were the same due to the price cap imposed on them. Therefore, this results in affordable housing in city centres being more desirable, as the affordable housing located further away in the fringes. This condition also were the highlight in the mismatch of affordable housing reported by Saleh et al., (2017). The researcher thus decides to include this indicator as part of research in this review paper.

CONCLUSION

In concluding this review paper, the researchers have gone through the methodology to obtain suitable previous research to be incorporated and extracted the indicators for the eventual data collection procedure. Based on the systematic literature review conducted, seven extracted themes were deemed significant for further measurement in further research. It is important to gauge the actual sampled size afterwards, as the recommendations from further research can be utilized by various stakeholders in determining affordable housing, with the improvement relating to road infrastructure indicators in the context of Malaysia. The themes reviewed also provided the researchers with overall understanding on the willingness of commuters travelling long distances, enduring traffic congestions, incurring high cost of travel and others. This showed that to fulfil the basic need of owning houses that were affordable and comfortable, the average commuters were willing to endure hardships on the roads on a daily basis, taking risks that were deemed acceptable to them.

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Tarikh : 20 Januari 2023

Prof. Madya Dr. Nur Hisham Ibrahim
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Tuan,

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2. Adalah dimaklumkan bahawa pihak kami ingin memohon kelulusan tuan untuk mengimbas (*digitize*) dan memuat naik semua jenis penerbitan di bawah UiTM Cawangan Perak melalui Repositori Institusi UiTM, PTAR.

3. Tujuan permohonan ini adalah bagi membolehkan akses yang lebih meluas oleh pengguna perpustakaan terhadap semua maklumat yang terkandung di dalam penerbitan melalui laman Web PTAR UiTM Cawangan Perak.

Kelulusan daripada pihak tuan dalam perkara ini amat dihargai.

Sekian, terima kasih.

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Saya yang menjalankan amanah,

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Timbalan Ketua Pustakawan

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Setuju.

27.1.2023

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