The effect of residential choice on the travel distance and the implications for sustainable development

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The effect of residential choice on the travel distance and the implications for sustainable development

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Abstract. For Medan citizens, the choice of residence location depends on the ability to buy a house. House price is determined by the price of land where the housing is located. The more to the edge of the city the location of a house, then the price will be lower. So that the suburbs of Medan become the residential choice for the citizens of low-income. The residential choice will affect the distance of the journey to the workplace. This study analyzed the effect of residential choice on the travel distance and the implications for the implementation of sustainable development. The data used in this study is the primary data obtained through the survey held in Medan. The research approach is quantitative with the data analysis technique of Structural Equation Model (SEM). The results show that low-income citizens tend to choose the location of suburbs, while they work in the urban area. The location of the residence affects the daily travel distance is very high. The travel distance that is the very high effect the use of private vehicle mode. The use of private vehicles for long travel distance requires a huge energy. The use of very high fuel oils is a waste of energy and can increase air pollution. This is not in accordance with the concept of sustainable development.

Keywords: Residential Choice, travel distance, and sustainable development

1. Introduction
The house serves as a habitable living place, a means of family coaching, a reflection of the dignity and dignity of its inhabitants, as well as assets for its owners. Housing is the most basic need for people after food and clothing needs. The residential location perspective for person is initially influenced by a person's willingness to settle or not, but as the development of community, the people will experience the dynamics of change of reasons in choosing the location of the residence, such as the convenient location of the neighborhood, access to the city center and other facilities, or other benefits. But the change of the perspective above depends on income or economic factors. Someone with a low income will tend to choose a cheap residential location because of its limited paying ability, but someone with a high income will tend to prefer a residential location close to all the conveniences and facilities that are needed.

Each person must have their reasons for the need for the place of residence. One of them is the desire to get a comfortable environment and good residential facilities, such as the distance to a place close to the workplace and the ease of transportation with a choice of adequate transportation modes.
The location of a residence away from the city center tends to have an inadequate mode of transportation where transportation is very limited. In addition to the convenience of the facilities available, another reason for choosing a residence location is because of the location close to the location of its activities, such as close to the workplace location. Employment is typically concentrated in the center of the city, so low-income communities tend to prefer suburban dwellings will travel further than people living close to the city center.

This further journey will certainly have an impact on the environment due to the increasing intensity of motor vehicle usage that will contribute to the increase of air pollution, where air pollution will affect the health of road users. By living in an area far from the city center of course travel time will be further and longer so that carbon emissions of vehicles wasted will be more, this is certainly not in accordance with sustainable urban development.

This study will analyze the effect of residential choice on the travel distance and the implications for sustainable development. This study aims to determine the effect of residential choice on the choice of modes and the distance of travel to the workplace and its consequences to the application of the concept of sustainable development.

2. Literature
The choice of the location of the residence depends on the ability to buy a house meaning that with a higher economic level will be able to buy a house close to public facilities [1] but with low socioeconomic conditions, people will choose further housing because of affordable prices [2]; [3].

This study will clarify the relationship between the selection of residential locations with the distance of travel and the selection of transportation modes used. There are many studies that focus on the physical characteristics for the selection of the location of the dwelling and how the location of the residence also affects the mode of transportation used to reach the residence.

Most studies have found that the built environment influences travel behavior [4]; [5]; [6]. Other research suggests that choosing a residential geographic location will affect travel [7]; [8]; [9]; [10]. Except the selection of residential locations that consider travel distance, residential selection also affects the mode of transportation used [11]; [12]; [13]; [14]; [15], [16].

3. Method
The design of this study was conducted based on the research stages. The first step is the preparation stage of the research by preparing the basic idea of the research plan. Having determined the basic idea of research, conducted a theoretical study related to the topic to determine the variables, indicators, methods of data analysis and research concept framework. The second stage is to pre-survey the research area to get a picture of the existing research area to design the research instrument undertaken.

The third stage in this research is the stage of data collection through the survey. The data used in this study is the primary data obtained through the survey held in Medan. The research approach is quantitative with the data analysis technique described in the Structural Equation Model (SEM). The use of structural equation model (SEM) data analysis techniques was also carried out by previous researchers in relation to travel behavior on the built environment [17] and [18] using SEM to examine the effect of using modes on sustainable development. The fourth stage of this research is the data analysis. With the SEM method, it will be known how the travel distance will affect the choice of residence location and the selection of the mode of transportation used. So, the direct and indirect effects of choosing the location of residence and the mode of transportation of the travel distance will be revealed. The fifth stage of this research makes a report of research results.

4. Results and Discussions
Along with the development of the human need for housing needs is also growing, this development causes people will tend to choose housing that has the facilities and adequate infrastructure to meet the needs of each day. Choice of residence location will always choose a place
close to the location of its activity, for example, close to the location of the workplace. So people are more likely to choose housing close to the city center, which has adequate facilities and infrastructure. This implies limited land demand due to high demand, so housing prices in the city center become more expensive than in the suburban.

Data collection techniques in this study were conducted in a primary survey conducted through interviewing questionnaires online through google form application. Survey results indicate that on average 39% of people choose to live 2-4 km from the city center, followed by 24% of people choose a residence located 4-7 km from the city center, 21% 7-15 km from the city center and 9% of the people chose to live in the area> 15 km from the city center and only 7% of the people chose to live in the area <1 km from the city center.

The community perception in choosing a place of residence is also associated with the distance of the location of the residence with the location of the workplace; the community will tend to choose the
location of the residence close to the place of work. But in its development, the location in city center area is more focused on the economic aspect where urban areas tend to become economic centers such as office areas, and it makes housing prices in urban areas will be more high.

From the survey result, the distance traveled to the workplace shows that on average 32% of people travel as much as 5-10 km per day, followed by 28% of people traveling 2-5 km per day, 18% of people travel as much as >15 km per day, 18% of people travel as much as 10-15 km per day and only 7% of people travel as much as <2 km per day.

![Travel distance](image)

**Figure 3.** Travel distance.

From the survey results in travelling, the people are more likely to choose to use private transportation, this is evident from the use of motorcycles that reached 58%, followed by the use of private cars as much as 23% and only 14% of respondents who use public transport to travel.

![Mode choices](image)

**Figure 4.** Mode choices.

In the previous studies only studied the relationship between residence location and travel behavior on vehicle ownership, so in this study, researchers will examine how the influence of residence location, the selection of modes of transport, the distance of travel, and in the use of fuel whether it has been in accordance with sustainable development. This study is in line with [17], the results show that the built environment can influence the mode selection.
This study shows that the built environment in the suburban have the impact on the use of very high motor vehicles in Medan. The choice of modes with motorized vehicles for travel to work more dominant in Medan. In other city, [19] showed the same thing that commuting trips to take children to school, people prefer private vehicles.

Therefore, this research will test the influence of the four variables above by using SEM method.

In the picture, there are four paths which will later answer the relationship between the four variables to be tested. The four variables to be tested are residential location, selection of modes of transportation, the distance of travel and sustainable development seen from the use of fuel and carbon emissions of vehicle disposal.

The choice of location of residence depends on the economy of the community, meaning it depends on the ability to buy a house. With low incomes, the ability to buy a house will be low anyway. It will certainly affect the selection of modes of transportation used; the people will tend to use private vehicles, it is seen from the number of respondents who choose to use private vehicles to travel due to distance location of residence away from the city center. Remotely distant locations will lead to greater use of fuel energy which will certainly have an impact on sustainable development. The relationship of these four variables can be seen in the table of SEM test results below:

| Estimate | S.E.  | C.R. | P    |
|----------|-------|------|------|
| MODE_CHOICES ← LOCATION | 2,435 | 11,592 | .210 | *** |

The SEM calculation results as presented above indicate that the selection of residential location has a positive effect on the selection of modes of transportation. It can be seen from the coefficient of positive sign of 2,435 with CR value 0.210 and obtained significant probability (P) equal to 0.000. This means that when the distance to the location of the residence is further away, then the use of transportation modes will increase, in this case, the transportation mode studied is the public assessment of the effectiveness of private vehicle use (X1.1) and the likes of private vehicle use (X1.2). Means that people will prefer to use private transportation to the workplace.

The selection of the residential location in the suburban area is favored by the people of Medan because the price of land in the suburban area is relatively lower and affordable by low-income people. Currently, the suburban area is a very widely used residential development site. Suburban
housing areas have not been serviced by public transport with better service levels. The low level of public transport services has consequences for the selection of preferred personal vehicle modes.

[20] finds the built environment will affect the use of modes. Commuter trips use more private vehicles. To reduce the use of personal vehicles, it is necessary to plan closer housing around the point of residence with better public transport services. Characteristics of mode selection can influence the quality of urban environments [21].

Selection of residential location is less consider the balance to the workplace. Many residential locations are very far from the workplace. The choice of residence depends largely on the selection of modes to be used for distance and travel purpose. This is in line with research conducted by [22]. It can be seen the influence of mode selection on the distance of travel in this following table.

**Table 2. SEM test results of the influence of the mode of transportation on the distance of travel.**

|                      | Estimate | S.E. | C.R.  | P   |
|----------------------|----------|------|-------|-----|
| TRIP_DISTANCE ← MODE_CHOICES | -0.347   | 0.195| -1.780| *** |

The SEM calculation results as presented above indicate that the selection of the transport model negatively affects the travel distance. It can be seen from path coefficient with negative sign equal to -0.347 with CR value equal to -1.780 and obtained significant probability (P) equal to 0.000. This means that when the distance to the location of the residence farther, then the use of modes of transport, in this case, private transportation will increase. This is also in line with the survey results that show the use of private vehicles is more dominant as much as 81%.

Currently, public transport services are not in demand by the community due to the interconnection between modes so that people are more likely to use private vehicles effectively without having to change the mode of transportation when using public transport. The unavailability of buses that serve in suburban housing areas makes it difficult to use public transport to work. With the travel distance to be traveled further and travel time is longer, then the personal vehicle is much more desirable.

The impact of travel distance on the concept of sustainable urban development can be seen in the following research results.

**Table 3. Results of the SEM test the effect of travel distance on sustainable development.**

|                           | Estimate | S.E. | C.R.  | P   |
|---------------------------|----------|------|-------|-----|
| SUSTAINABLE_DEVELOPMENT ← TRIP_DISTANCE | 0.016    | 0.300| 0.053 | *** |

The SEM calculation results as presented above indicate that the distance of travel has a positive effect on energy wastage. This can be seen from the positive sign coefficient of 0.016 with CR value of 0.053 and obtained a significant probability (P) of 0.000. This means that when the travel distance further, then the use of fuel will certainly increase so that air pollution caused by vehicles in the city will also increase. The use of private vehicles for long destinations requires enormous energy sources. The use of very high fuel is a waste of energy and can increase air pollution; this is not following the concept of sustainable development.

[23] states that long travel can increase CO2 emissions usage that are harmful to the environment. Air pollution caused by the use of motor power can damage health [24]. Travel behavior that uses public transport, private vehicles, cycling and walking can affect the quality of urban environments [18].

The construction of a very high residential area in the suburbs is not followed by the provision of massive public transport impacting the waste of energy used by private vehicles. The waste of energy is very much against the application of the concept of sustainable development.
The policy of reducing the use of motor vehicles in the suburban areas can be done as [25] which suggests that the provision of public transportation and land use arrangement by mixing. According to [26] non-motorized policy can improve the application of the concept of sustainable development with the promotion of bicycle and walking program. Implementation of this policy can be implemented on the suburban area with the pattern of travel citizens to work in the city center can be implemented with the concept of development of Transit Oriented Development connected with mass public transport facilities. In accordance with [27], urban TOD increases the use of public transport and reduces car use.

5. Conclusions
The results of this study indicate that people with low income tend to choose the location of residence in the suburban because the price of the residence in the city center is higher than in the suburbs. The location of this residence affects the daily travel distance is very high because they work in the city center. This very high travel distance affects the use of private vehicle mode. As a result, the increased use of private vehicles to travel will require a larger source of energy. The use of very high fuel is a waste of energy and can increase air pollution. This is not following the concept of sustainable development.

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