Travel behavior of urban kampong residents and formal housing residents for shopping activity: Case of Yogyakarta City

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Abstract. Shopping is one of the important activities that is carried out by the residents to meet their daily needs. It also has some relationship with the built environment condition around the resident’s houses. If the residential area cannot provide the needs of the residents, then the residents will travel out of the residential area, especially using private vehicle. Yogyakarta is one of the city in Indonesia which has a type of settlement that can support sustainable development by increasing pedestrian trips. On the other hand, the number of private vehicles in Yogyakarta always increase year by year. Therefore, the aim of this study is to identify the travel behavior for shopping activity at two kinds of urban settlement which have some differences in their built environment condition. This study is conducted by quantitative method with data collection using questionnaires and it is assisted by field observation. The result of this analysis using Mann Withney U-test shows that there are some differences of shopping travel behavior between urban kampong residents and formal housing residents. However, the chi-square test shows some weak relationships between travel behavior and built environment. In the other words, built environment does not significantly affects the shopping travels in Yogyakarta city, as well as many developed theories.

Keywords: shopping trip, travel behavior, transportation, urban settlement, built environment

1. Introduction

Analysis of travel behavior is the first step in transportation modelling [1]. Spatial transportation modelling is closely related to the generation and attraction of trips that on the respective zones. Hence, travel behavior describes about human activities (working, shopping, school, etc) and how human use transportation such as destination, distance, travel time, and vehicles used [2]. Then, on travel behavior, the trip generation zone or the main origin zone is the settlement zone, which can generate 80-90% of trips in urban areas. Therefore, settlement as trip generation area will have a major influence on transportation in the city.

City is formed as a function of complex human activities. Activities within the city are the expression of the people's efforts to meet their needs. Therefore, the city cannot be separated from transportation system since transportation is a derivative need due to the need of daily needs fulfillment such as school, work, shopping, recreation and so on [3]. The relationship between travel behavior and daily need fulfillment can be shown by travel behavior that has been explained above.

Shopping is one of the important activities that is carried out by people almost every day. This is a way to meet their daily needs especially for food, drink, cloth, and so forth. Moreover, the major economic sector which dominates in a city is the trades and services sector (tertiary sector). Regarding to travel behavior, it
will affect to the mobility within the city which is also dominated by shopping activities or shopping trips. But, especially in Indonesia, there has not been much researches on shopping travel behavior. It is suspected because shopping travel is not a routine trip like working or school [4].

Yogyakarta is one of the city in Indonesia which has a good economic growth, especially on the trades and services sector. The trades and services sector based on data on 2017 dominated the economic structure about 7.49 percent [5]. The growth rate for trades and services sector also increases in general. Thus, the effect of the increasing of the trades and services can affect to the enhancement of shopping trips in Yogyakarta. In addition, Yogyakarta City must be able to anticipate the impacts of economic growth to urban mobility so that the development in the city can run sustainably.

The condition of Yogyakarta City is well-known as a city of Indonesia, especially for higher education. It is not actually a big city, but it has a high spatial hierarchy and rapid growth that attracts researchers to conduct research in Yogyakarta City. The physical conditions of the settlements in the city of Yogyakarta is quite diverse and also have a form of traditional Indonesian settlements, namely “kampung kota” or urban kampong [6]. The location is around the city center with high density, diverse of land use, and interlinked area design. Those conditions should be able to generate more sustainable trips. On the other hand, some different conditions are found at formal housing that developed in Indonesia recently and tend to have homogeneous impression, the design is less connected and lack of accessibility due to its development leading to the suburbs.

As many developed theories state that the settlement form factors which are seen from built environmental factors such as density, land use diversity, accessibility, design and distance to transit facilities can influence travel behavior [7]. In more detail, dense settlements with mixed land uses will increase proximity so that the travel can be reached only on foot [8]. Hence, Yogyakarta City which has many settlements with mixed land use characteristics, namely the urban kampong, should be able to reduce travels by using private vehicles. However, in Yogyakarta City, there has been an increasing in the number of private vehicles every year, even in 2016-2017 the number of motorcycles increased around 211% [9]. Those conditions give rising to the initial suspicion that there are some differences on the influence of built environment factors on travel behavior in Yogyakarta City if it is compared to theories that have been developed.

2. Research design

2.1 Defining urban kampong and formal housing
Urban kampong is defined as a settlement that is built by community’s initiation (self-help housing) and without being planned carefully through a planning process or can be called unplanned development. Urban kampong is usually used to explain dichotomies between villages and cities, namely cities that are interpreted as modernity and kampong which is defined as backwardness, inequality, and all things that are not good. On the other hand, urban kampong has diversity in land uses so that the local needs of the community can be fulfilled in their own environment. In addition, the suburban area has begun to be filled with a more modern form of housing, which is planned by the government or developer or in this study called formal housing (planned development). Formal housing is usually categorized as gated community which causes homogeneity and limited access to facilities in close proximity. Therefore, residents have to travel out of their settlement area to meet the local needs with longer distances.

2.2 Data collections
The data collection method is using questionnaires that randomly spread using simple random sampling to 200 respondents who live in urban kampong and formal housing in Yogyakarta City. The respondents are selected by giving number to each house in the case study’s area, then the numbers are picked randomly. There are two locations of urban kampong and two locations of formal housing that are selected by some criterion such as location distribution, distance from core activity, public transportation affordability, building density, and street pattern. The selected area are Tukangan Kampong, Kricak Kidul Kampong, Puri Timoho Asri Residence and Green House Residence. This study is also complemented by field observation to assess the built environment condition. The criterion and the location of case study are shown below:
Table 1. Some criteria to choose the case study

| Location                  | Distribution | Proximity to activity center | Public transport affordability | Building density | Street pattern |
|---------------------------|--------------|------------------------------|-------------------------------|------------------|----------------|
| Kricak Kidul Kampong      | North side   | Far away from CBD and government center | Passed by public transport | Moderate         | Organic        |
| Tukangan Kampong          | Middle side  | Near the CBD                 | No public transport           | High             | Organic        |
| Puri Timoho Asri Residence| North side   | Near the government center   | Passed by public transport    | Moderate         | Cul-de-sac     |
| Green House Residence     | South side   | Far away from CBD and government center | No public transport           | High             | Grid           |

Figure 1. The location of case study

2.3 Data analysis

The result of the questionnaires are analyzed using Mann Withney U-test to assess if there are some differences or similarities of the mean between the frequency, distance and mode choices that done by urban kampong residents and formal housing residents on shopping purpose. Then, the relation between built environment (independent variable) and travel behavior (dependent variable) is analyzed using chi-square analysis with the formula as follows.

\[
X^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}
\]

\(X^2\) : Chi square value  
\(k\) : The number of class  
\(O_i\) : Observed frequencies  
\(E_i\) : Expected frequencies

This study also uses hypothesis, namely:

a. Null hypothesis: There are no differences between the dependent variable with independent variable of urban kampong residents and formal housing residents.
b. Alternative hypothesis: There are some differences between the dependent variable with independent variable of urban kampong residents and formal housing residents.

In addition, for the built environment measurement is using scoring method based on the theories and standards as follows. The unit of built environment measurement is by an area. In the other words, the score is given to each area (each case study) which is delineated using 100 meter radius.

a. Mix Land Uses analyzed using entropy with the formula:

\[
\text{Land-use mix} = \left( -\frac{1}{\ln(n)} \right) \sum_{i=1}^{n} \frac{b_i}{a} \ln \left( \frac{b_i}{a} \right)
\]

Where is:
- \( b_i \) = the area of each land use
- \( a \) = the total area
- \( n \) = the number of land uses

b. Building density analyzed using Building Coverage Ratio (BCR) with the formula:

\[
\text{BCR} = \frac{\text{Built area}}{\text{Total area}}
\]

c. Scoring analysis to know the rate of facilities affordability. The analysis based on Indonesian government standard named SNI 03-1733-2004.

3. Travel behavior for shopping purpose

3.1 Travel frequency
Frequencies are defined as the intensity of a travel during a week. Nonetheless, in this study the travel that is counted just the travel that always happened every week. The result from 200 questionnaires show that there are 162 shopping travels in urban kampong and 161 shopping travels in formal housing. It is happening because one family could go shopping in some difference places in a week, for instance to the public market, store, and \( \textit{warung} \). For shopping activity, the composition of travel frequencies are shown below:

![Figure 2. Composition of shopping frequencies of urban kampong residents](image)

![Figure 3. Composition of shopping frequencies of formal housing residents](image)

From those figures, it can be concluded that urban kampong residents are more often travelling for shopping than the formal housing residents. About 57 percent of the shopping travels of urban kampong residents are carried out very often. However, only 30 percent of the shopping travels of formal housing residents are carried out very often, thus formal housing travels are more dominated by the rare frequencies. When the mean of frequency is compared using Mann Withney U-test, the result shows that there are some differences between the mean of shopping frequencies of urban kampong residents and formal housing residents as shown below:
Table 2. Mann Withney U-test result for travel frequency

| $\alpha$ | p-value | Count-Z | Table-Z |
|---------|---------|---------|---------|
| 0.1     | 0.000   | 4.736   | 1.67    |

The value of Count-Z (4.736) > Table-Z (1.67), thus the null hypothesis is rejected which mean there are some differences between the mean of shopping travel frequency of urban kampong residents and formal housing residents. This fact is happening allegedly due to shopping facilities that more variable in urban kampong rather that in formal housing. Moreover, it also allegedly due to the economic condition that affects to the buying capability namely the formal housing residents could buy more things at once rather than the urban kampong residents. Thus, the urban kampong will go shopping more often because they only can afford few things at once.

3.2 Travel distance

Travel distance is defined as the distance that is traveled by a person from their house to the location of destination. The distances are grouped into two categories such as near (less than 400 meter), moderate (400 meter-5 kilometer) and far (more than 5 kilometer). The analysis of shopping trip’s distance categories is shown by the graphs below:

The graphs above show that the urban kampong residents prefer to go shopping just around the walking distance. However, the formal housing residents prefer to go shopping on vehicle distance, although those are 33 percent travels that are traveled in walking distance. Although, the formal housing does not have some shopping facilities like warung, or store near it, the residents still can buy their daily needs in walking distance because there are some traders who move around the housing. Thus, the residents do not need to travel out from their housing area. This is one of the uniqueness that is found in Indonesia.

Table 3. Mann Withney U-test result for travel distance

| $\alpha$ | p-value | Count-Z | Table-Z |
|---------|---------|---------|---------|
| 0.1     | 0.000   | 1.825   | 1.67    |

The table above shows that the value of Count-Z (1.825) > Table-Z (1.67) which mean the null hypothesis is rejected. In the other words, there are some differences between the mean of shopping travel distance of urban kampong residents and formal housing residents. On the other hand, the difference of the travel distance is not to significant. It’s only 433.5 meter.

4. Built environments that affect travel behavior

4.1 Built environment condition

Built environment conditions are analyzed using four variables which are selected from the previous theories. The selected variables that have been explained on part 3 namely: density, mixed land use, design, and destination accessibility. The measurement of those variables are using scoring method
based on the theories. Then, the result from those scoring method in each area would be compared each other to define the highest class until the lowest class. Scoring analysis results are shown below:

### Table 4. Built Environment Condition

| Variables          | Kricak Kidul Kampong | Tukangan Kampong | Green House Residence | Puri Timoho Asri Residence |
|--------------------|----------------------|------------------|-----------------------|---------------------------|
| Density            | high (92.84)         | very high (202.4)| high (71.74)          | low (52.35)               |
| Mixed Land Uses    | mixed (0.27)         | low mixed (0.22) | moderate (0.23)       | low mixed (0.20)          |
| Design             | good (350)           | good (397)       | moderate (314)        | good (106)                |
| Destination Accessibility | good (121.73) | good (121.33)     | good (101.78)         | moderate (79.66)         |

The result of built environment measurements can show that the urban kampong has better built environment condition rather than the formal housing, except the mixed land use in Tukangan Kampong which has a low score. This condition can be related with sustainable transportation with the indicators are compact, dense, transit, connect, mix, cycle, shift, and walk [10]. Based on the result of built environment analysis, it can be concluded that urban kampong area is more compact, dense, and connected. Hence, the condition of urban kampong area should promote sustainable transportation rather than the formal housing area.

#### 4.2 The Relationship between built environment and travel frequency

The analysis of relation between built environment and travel frequency is using cross-tabulation analysis. The result of this analysis shows that all of the p-value in each variable is less than α (p-value < α). It means that all of the variables affect travel frequency in shopping trips. On the other hand, the Somers’ d coefficients (C) show very low until low connections. Some value of Somers’ d coefficients are less than 0.199 so the connections are very low [11]. Moreover, some value of Somers’ d coefficients are between 0.20-0.399 so the relationships are low[11]. The relationship table shown below:

### Table 5. Chi-Square analysis for travel frequency

| Variables          | α       | p-value | C     |
|--------------------|---------|---------|-------|
| Density            | 0.000   | 0.180   |
| Mixed land uses    | 0.1     | 0.000   | 0.198 |
| Design             | 0.000   | 0.220   |
| Destination accessibility | 0.000 | 0.263   |

The value Somers’ d coefficients are showing positive value. It means that the relationship between built environment condition and travel frequency moves on the same side. If the value of built environment grows better, than the shopping travel will be carried out more often, and vice versa.

Between all of those built environment variables, destination accessibility and design are strongly affecting the travel frequency than others. It is supposed that the distance to the shopping facilities and the residential design which is comfortable to pedestrians could increase the shopping frequency. This condition could make the residents easily reach the shopping facilities so the trips would be carried out frequently.

#### 4.3 The relation between built environment and travel distance

This analysis for the correlation between built environment and travel distance is using the same method with the previous analysis for the travel frequency. The result of this analysis also shows the same meaning. The p-value of all of the relation between built environment and travel distance are less than (p-value < α ) and some of the Somers’ d coefficient are less than 0.199 and between 0.20-0.399. Those result show the conclusion that the built environment can affect the travel distance but not to significant as the table below:
Table 6. Chi-Square analysis for travel distance

| Variables                  | α   | Travel frequency |
|----------------------------|-----|------------------|
|                            |     | p-value           | C            |
| Density                    | 0.001 | 0.107            |
| Mixed land uses            | 0.000 | -0.096           |
| Design                     | 0.000 | -0.159           |
| Destination accessibility  | 0.000 | 0.263            |

The built environment variable which is strongest affecting the travel distance is the destination accessibility and the weakest is the mix land uses. It can be concluded that the distance to shopping facilities (accessibility) is more important than area of shopping facilities which is measured by entropy index. This study shows one of the uniqueness of shopping trips in Yogyakarta that the distance of shopping trips are not only determined by the location of built up facilities, but also the unbuilt facilities namely moving traders or “pedagang keliling”. The moving trader comes to the residential area every morning to serve the residents with their daily needs such as vegetables, meats, fruits, and so forth.

However, the result of the Somers’ d coefficients on travel distance analysis show a little difference. The value of Somers’ d coefficients are negatively affecting travel distance. In the other words, if the value of built environment increase, than the travel distance will decrease but not to significant. This condition can shows that the built environments have not been affected Indonesian travel distance yet. But it can be a good beginning to promote sustainable transportation in Indonesia with some other ways.

5. Discussion

Based on the results of this study, the built environments are not significantly affecting the shopping trips as the previous theories have proved. For instance, the factor of land use diversity does not have a significant influence on shopping trips. This indicates that the diversity of land use which is assessed through entropy index is not the only indicator that determines the length of travel. Resident who lives in more homogeneous land use, namely in formal housing also can travel for shopping on short distance because there are traders who move closer to buyers. It shows that even though the entropy index is small, residents can still be served by commercial facilities properly. In the other words, this study want to give a new point of view namely to serve people with good access to facilities, not only thinking about the built facilities. It could be intervened by giving “moving facilities” to provide the local needs of people, for instance the moving trader or in Indonesia called “pedagang keliling”.

6. Conclusion and recommendations

This study tries to compare the condition of shopping travel behavior of people who live in urban kampong as undeveloped area and people who live in formal housing as developed area. It is related with the built environment conditions of those settlement area. Urban kampong is more dense, mix and accessible than the formal housing which is more homeny, less dense and lack of accessibility because it grows in suburbs. When the travel frequency and distance are compared, the result shows that urban kampong would generate more sustainable travels that the formal housing. It is proved by the mean of urban kampong’s travel distance that is shorter than the formal housing because it will produce less emissions.

However, the correlation between built environment and travel behavior surprisingly shows some weak relations. The built environments are not significantly affecting travel behavior in Yogyakarta City as have been mentioned by the previous theories. It could be affected by the uniqueness of Yogyakarta’s trading culture that moves closer to the buyer called “pedagang keliling”. Moreover it is also suspected because the residents consider about the quality of the shopping facility so they may travel farther to get the facility they need and they want. Nonetheless, the weak relationships between travel behavior and built environment could be a good beginning for Indonesia especially for Yogyakarta City to pay more attentions to built environment conditions. The provision of shopping facilities is not only thinking about the number of the facilities but also the quality of those facilities.

7. References

[1] Dimotriou, H.T 1992 Urban Transport Planning (London: Rutledge)
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